Lowering the Carbon Footprint: Making Agriculture More Sustainable in Alberta

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Presentation Outline

- Carbon footprint: the total amount of greenhouse gas emissions caused by an organization, event, product, or person.
- What is being done to reduce the carbon footprint in Alberta agriculture.
- Future movements to improve carbon footprints and make the public more aware of the issue.

Lacombe Field Crop Development Centre

COW

- Measure density of Greenhouse gases using cow research chambers
- Research cow genetics relating to lower emissions and more efficient feeding

CANOLA

- Canola is one of crops which grow efficiently
- Stagger the time of planting and research in differences in photosynthesis and growth

Lacombe Field Crop Development Centre

WEEDS

- It is most efficient to spray herbicide at the beginning of bud

IRRIGATION

- Use the power of gravity as much as possible

Lacombe Field Crop Development Centre

Instruments for measuring CO_2 emissions

Lacombe Field Crop Development Centre

Canola Research: getting more oil using fewer inputs such as fertilizer, herbicide, and fungicide.

Alberta Irrigation Technology Centre Demonstration Farm in Lethbridge

Devising better irrigation systems to improve efficiency and save resources, water, electricity and soil.

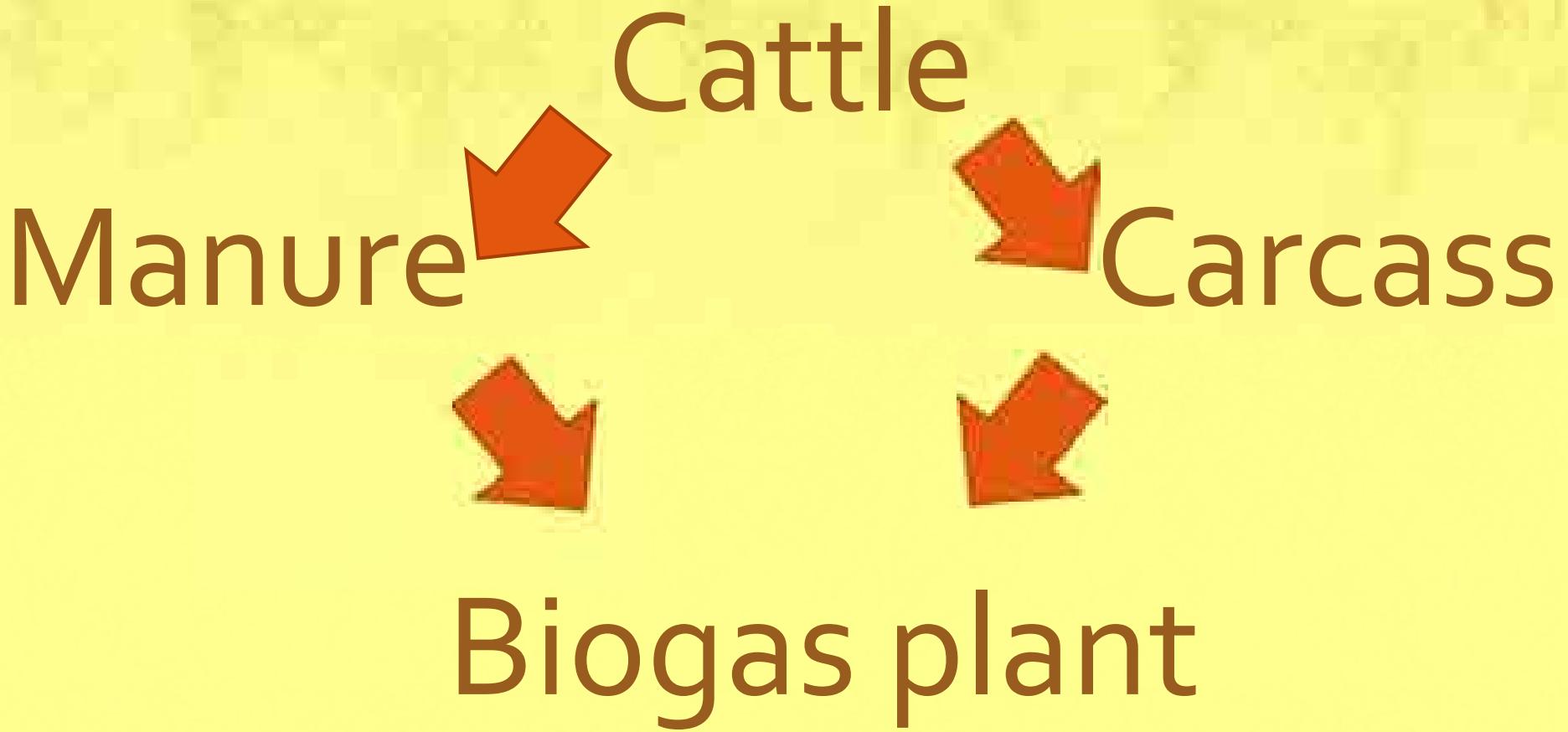
Feedlot farm with biogas plant near Vegreville

Farms emits a lot of carbon

- They need electricity, feeds, water, etc.....
- From cattle and manure, carbons are emitted

These factors increase the carbon footprint!!!

In the farm - improving efficiency



Carcass

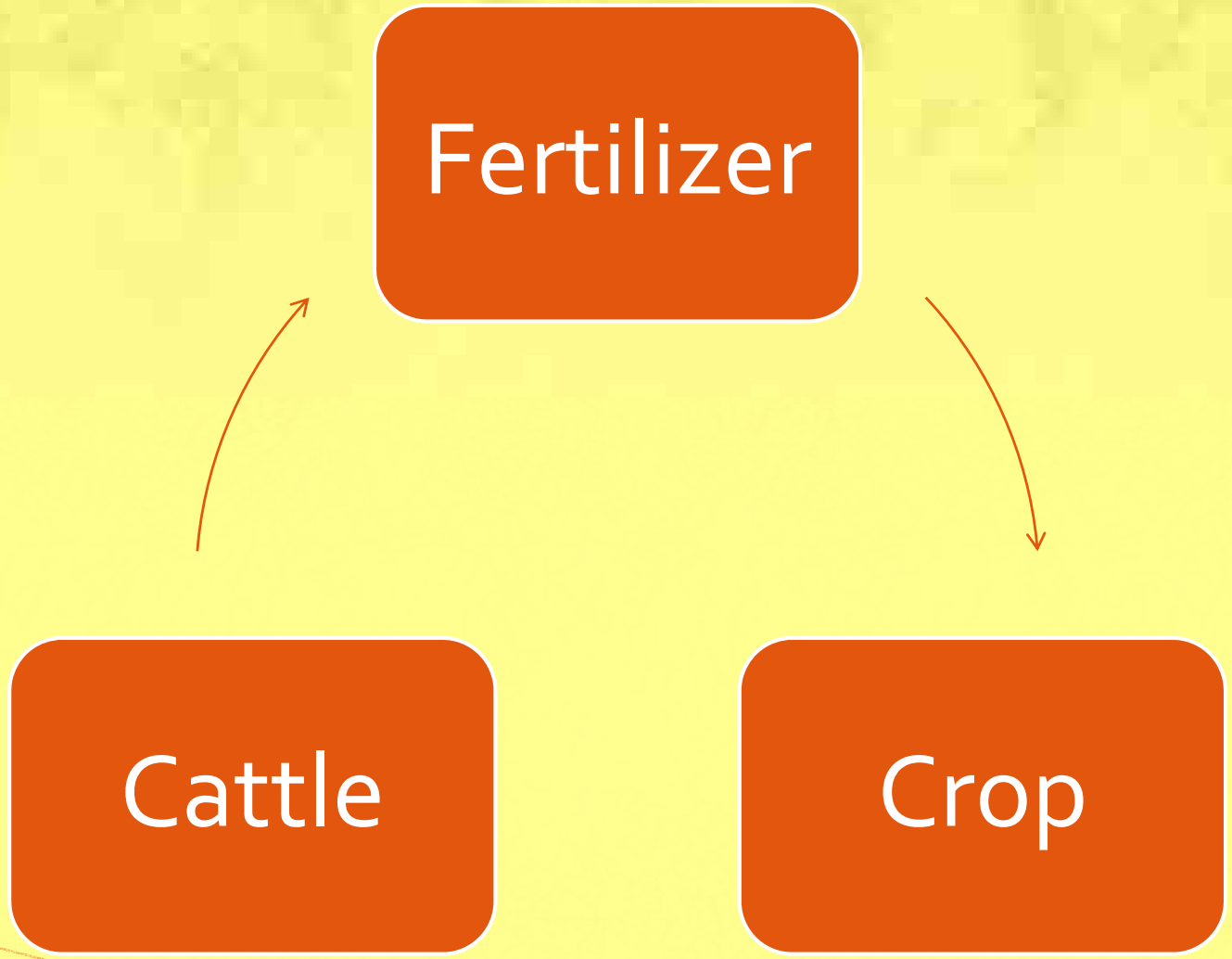
Manure

In the farm - improving efficiency

Biogas plant

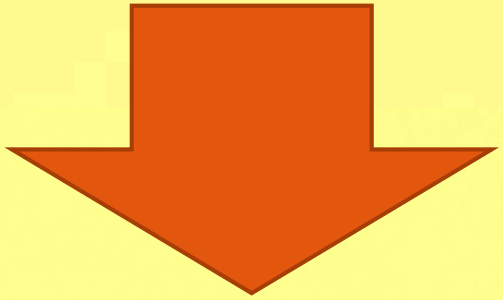
Fertilizer, Bedding,
Electricity, Ethanol ...

Circulation



Power generation

- Biogas plant provides electricity, and it is used at the farm.



decrease external electricity use

Ethanol

- Ethanol is used as fuel

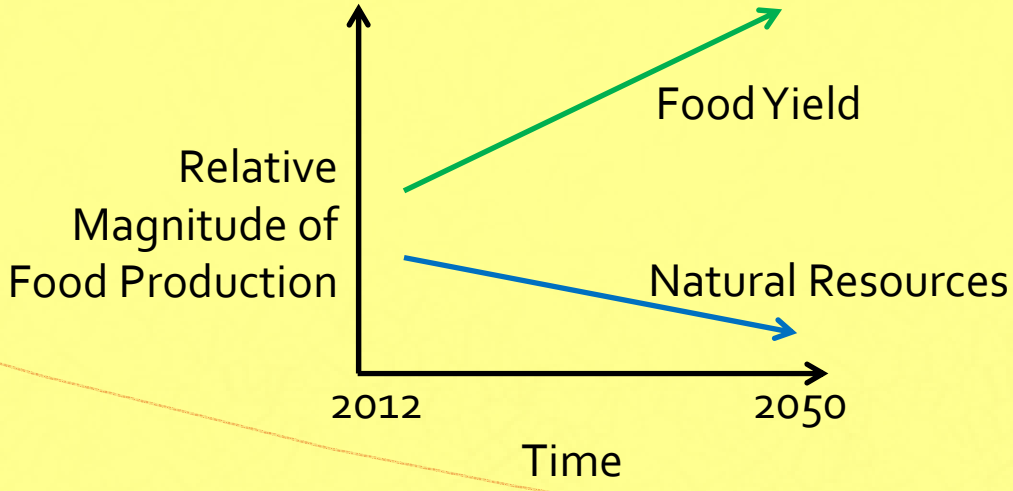
Conclusion

- The farm connects crops and cattle and biogas plant well

decrease carbon footprint

Lethbridge Research Centre

- Methane research – using environmental chambers to measure enteric methane from cattle.
  - Reducing cattle greenhouse gas emissions
  - Increasing global population
  - Increased food production with fewer resources



Average Impacts of livestock Production

- Dairy cow: 6 T CO_2e/year
- Beef cow: 3 T CO_2e/year
- Typical passenger car: 5 T CO_2e/year

Potential Solutions from Current Research

- Sustainability = reduce these greenhouse gas emissions at the source →

Small impact solutions

- Eat less milk/meat in the developed world

Large impact solutions

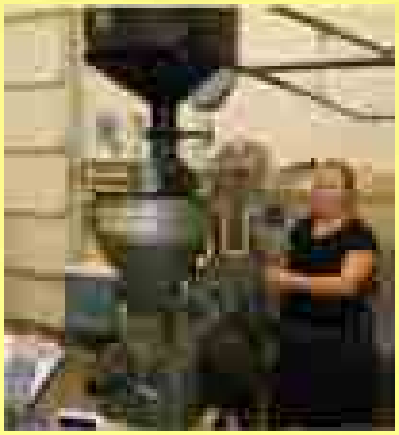
- Reduce enteric (intestine) fermentation
- Reduce resource inputs (feed quantity) and frequency of feeding (how often)
- Intensify production – more milk/meat per unit of greenhouse gas emitted, for example, by modifying the feed

Olds Biofuel Technology Centre

- Biodiesel is a renewable fuel that can be produced from plant oils and/or animal fats.

How Biodiesel is Produced

- Canola seeds heated and crushed in a screw press to extract the oils



- Use lower quality seeds
- Oil is filtered and mixed with KOH and a CH_4 to convert the oil (triglycerides) into biodiesel and glycerine (comes from the triglycerides).

How Biodiesel is Produced

- Methane flashed off in pressure vessel
- Centrifuge separates glycerine and biodiesel
- Biodiesel → resin filters
- Subsample → campus lab for grading and inspection

How Biodiesel is Produced

- By-products
- Solids → pressed cape → used for fertilizer, feed, biogas production, burned as fuel, etc.
- Methane – collected and reused after flashed off in pressure vessel.
- Glycerin – is quite "dirty" but can be used for feed, compost, biogas production, or put on gravel roads to reduce dust

Ethical Issues

- Human food? → Solution: Use low grade seed
- At Olds college, it costs $0.85/L to produce the biofuel (no profit made)
- Less expensive to produce biofuel than to refine diesel from fossil fuels → accounts for: costs of labour, extraction, land reclamation and oil refining

Ethical Issues

- Both biodiesel production and oil extraction have environmental impacts
- It can be argued that impacts of biodiesel production are smaller than oil production impacts

Final Note

As a society, we have to decide how much we are willing to pay ($) to reduce these impacts.

- The products may change
  - eg. Different material used for packaging, colour or other properties of the product may change slightly, etc.
    - Concern: How will the consumer respond to these changes to their products
- Need to get producers on board with this movement
  - Farmers could have to change their traditional ways of generating their product.

Water use in Alberta and Japan

Group 2

What is irrigation?

Irrigation is the artificial application of surface or ground water to promote plant growth.

It was first used by ancient Egyptians around 8000 BC.

In Alberta, we have explored four different irrigation systems, with many types of manipulations.

This includes Gravity Irrigation, Side Roll Irrigation, High Pressure Irrigation, and Low Pressure Irrigation.

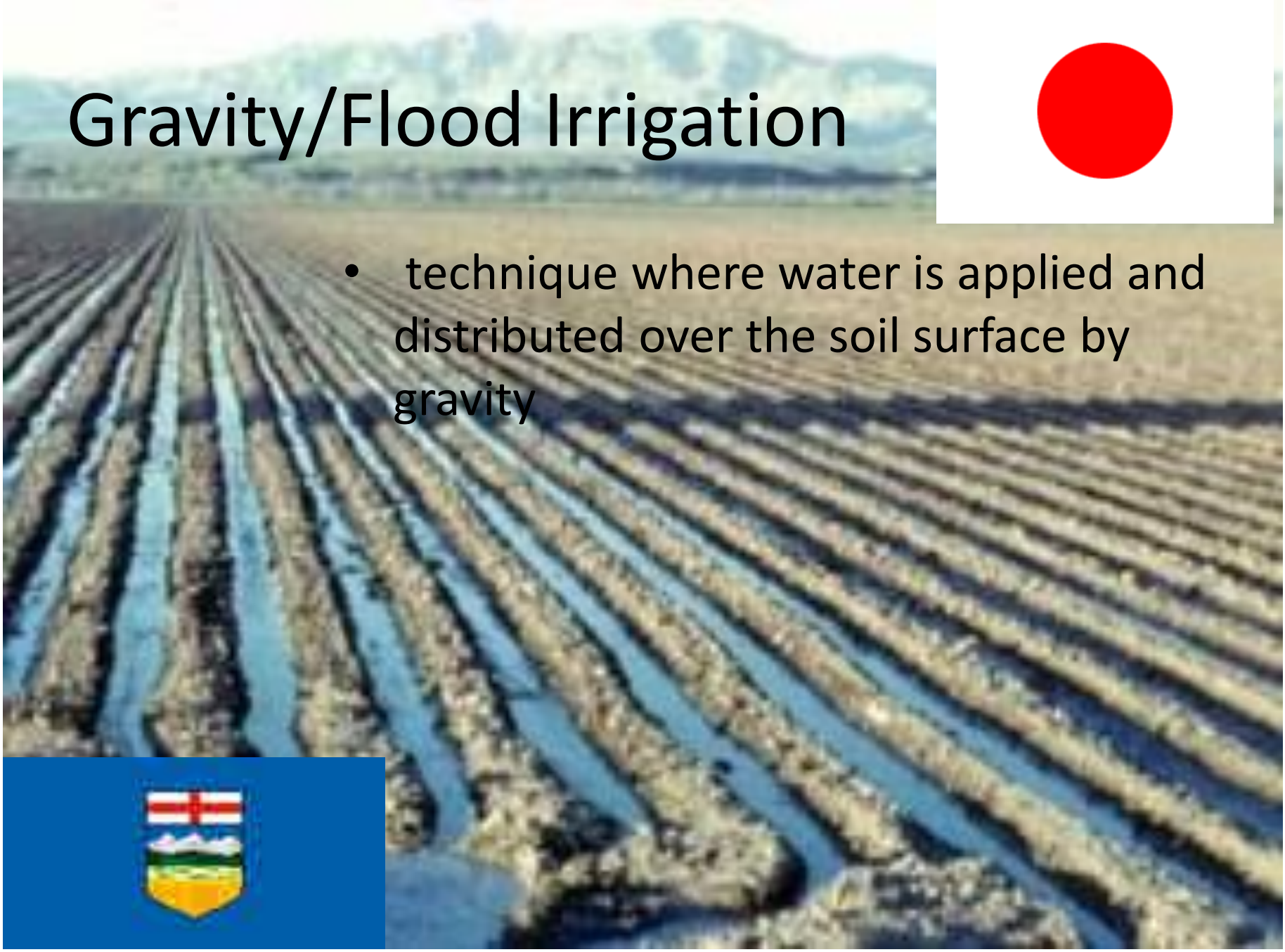
In Japan, Gravity Irrigation or Flood Irrigation are used in the production of rice

http://www.google.ca/imgres?q=ancient+irrigation&um=1&hl=en&sa=N&rls=com.microsoft:en-us&biw=1390&bih=821&tbm=isch&tbnid=A4Uuf1-9dzMEdM:&imgrefurl=http://westerlund09.wikis.birmingham.k12.mi.us/Charles%2Band%2BAlex%2Bacient%2Brome&imgurl=https://resourcesforhistoryteachers.wikispaces.com/file/view/rice_fields_Bali.jpg/32669529/rice_fields_Bali.jpg&w=800&h=547&ei=ou8_ULTWF6iDjAKYtYDgDQ&zoom=1&iact=hc&vpx=361&vpy=471&dur=452&hovh=186&hovw=272&tx=128&ty=121&sig=113607916428904141566&page=1&tbnh=139&tbnw=178&start=0&ndsp=24&ved=1t:429,r:13,s:0,i:114

http://en.wikipedia.org/wiki/Irrigation

Gravity/Flood Irrigation

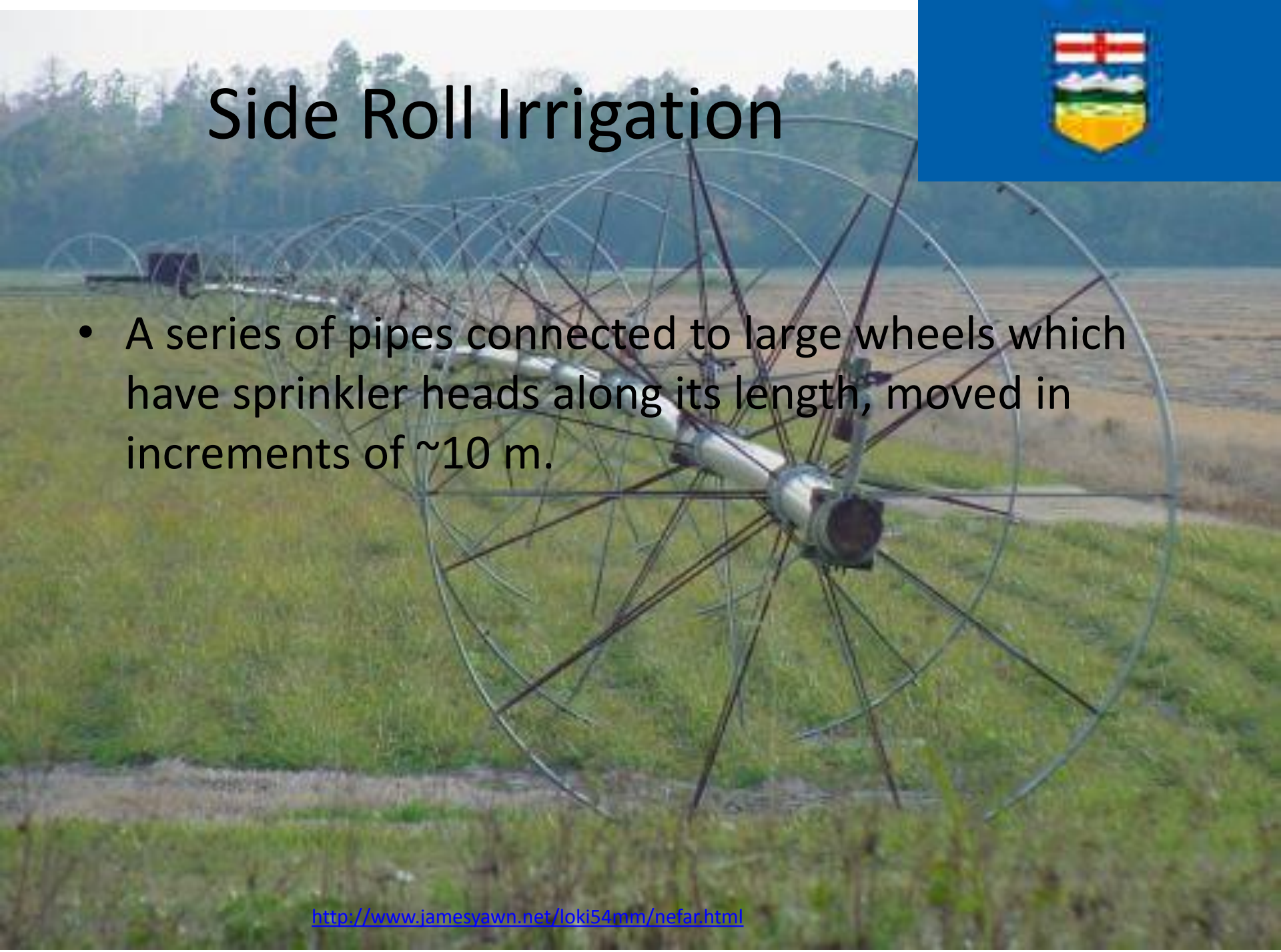
- technique where water is applied and distributed over the soil surface by gravity



http://home.howstuffworks.com/irrigation1.htm

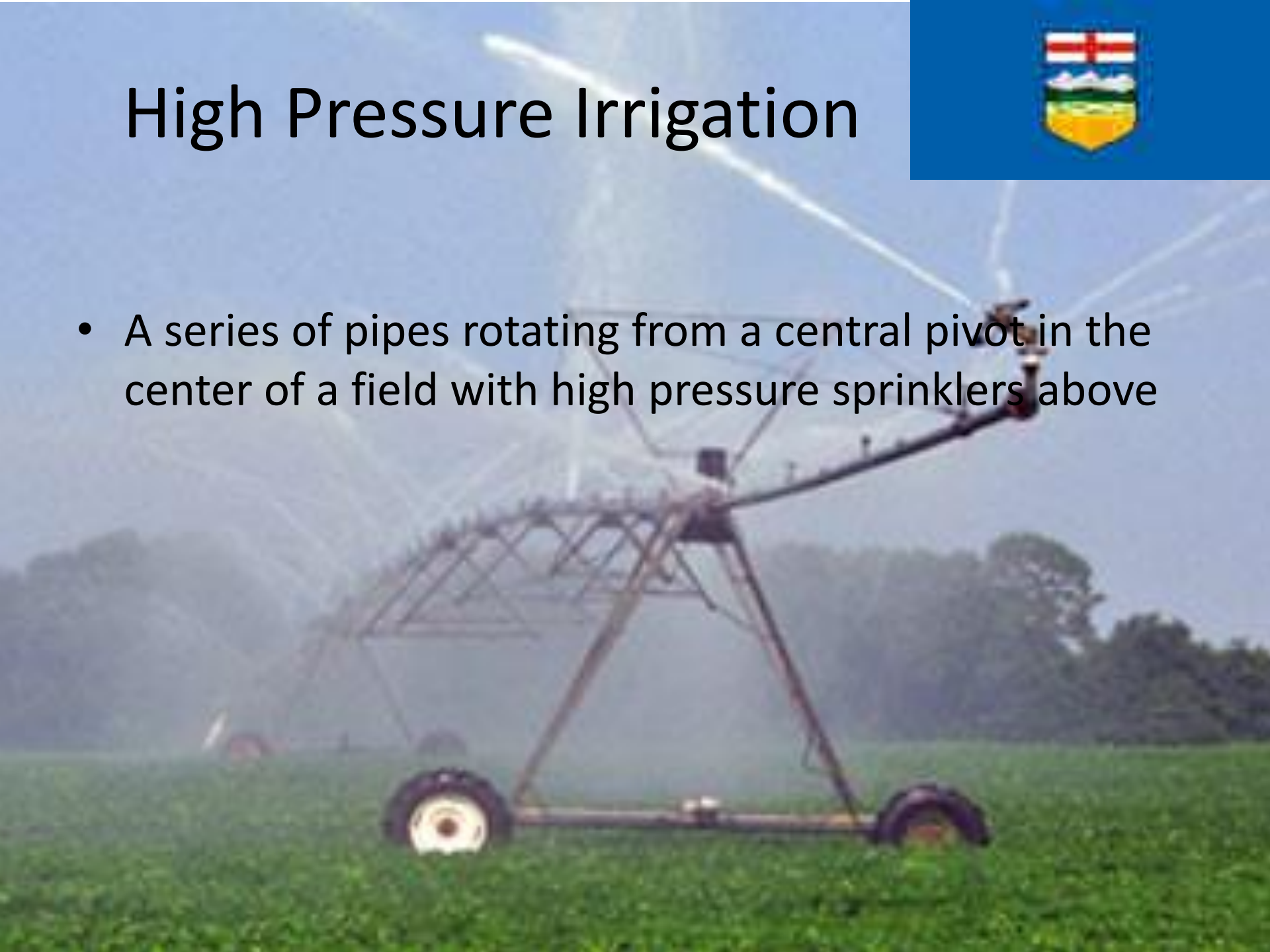
Side Roll Irrigation

- A series of pipes connected to large wheels which have sprinkler heads along its length, moved in increments of ~10 m.



http://www.jamesyawn.net/loki54mm/nefar.html

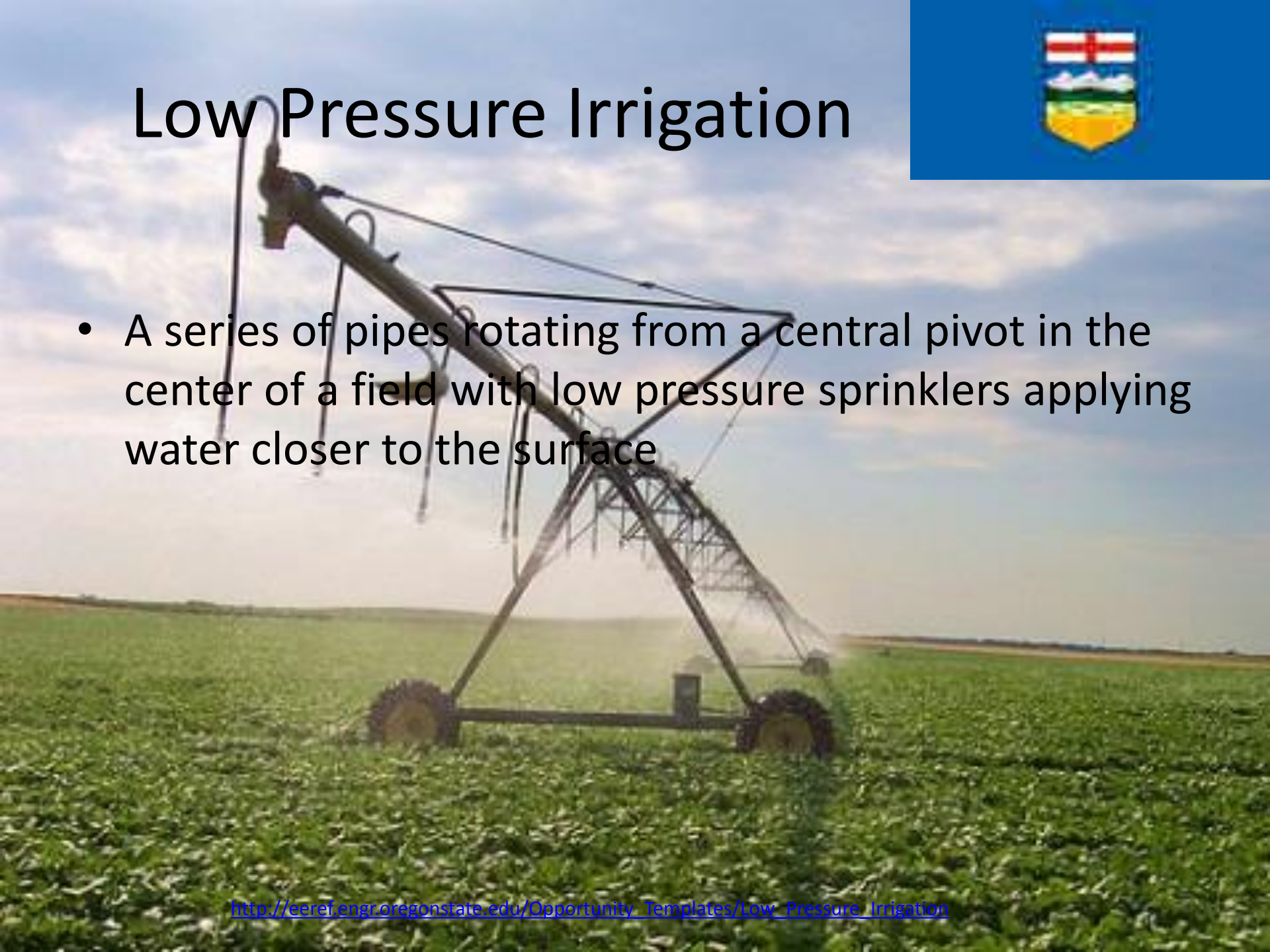
High Pressure Irrigation



- A series of pipes rotating from a central pivot in the center of a field with high pressure sprinklers above

Low Pressure Irrigation

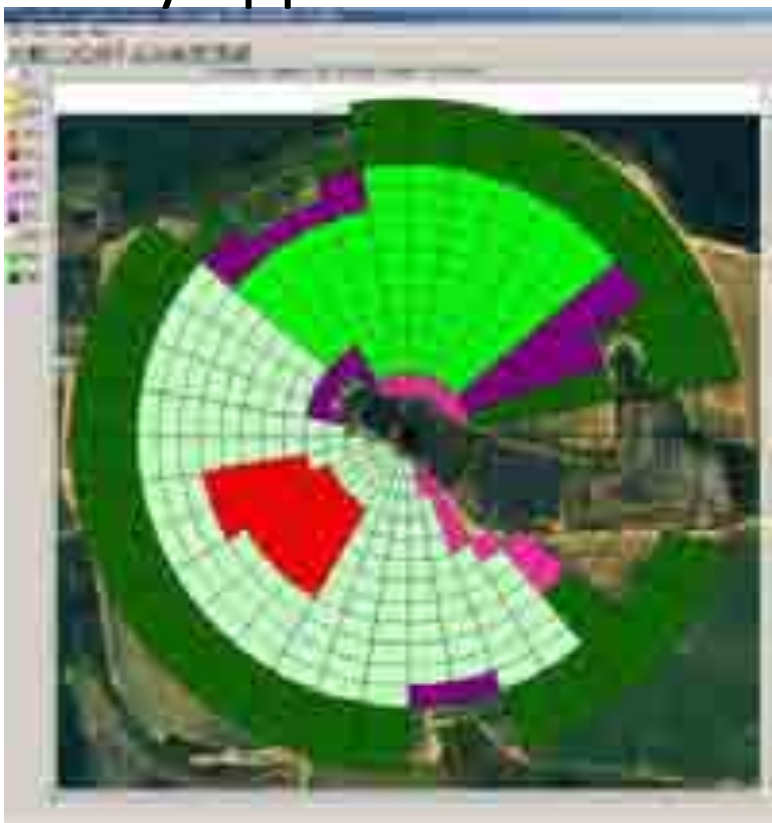
- A series of pipes rotating from a central pivot in the center of a field with low pressure sprinklers applying water closer to the surface



http://eeref.engr.oregonstate.edu/Opportunity_Templates/Low_Pressure_Irrigation

Variable Rate Irrigation

- Using a computer model and equipment, applying water volumes where needed, usually applied with low pressure irrigation



http://farmprogress.com/story-valley-will-offer-variable-rate-irrigation-0-35156

Crop Possibilities

- Corn
- Sugar Beets
- Potatoes
- Alfalfa (3-4 cuts)
- Fababeans
- Soy Beans (potentially)

How much water is used for irrigation?

Alberta

- Irrigation accounts for 60-65% of all water consumption in Alberta (4.2 billion cubic meters)
- 98% is collected from the snowmelt, 2% is from glacial melt

http://www.google.ca/imgres?q=alberta+irrigation&um=1&hl=en&sa=N&rls=com.microsoft:en-us&biw=1390&bih=821&tbm=isch&tbnid=x7IEB7UO99HAYM:&imgrefurl=http://www.aipa.ca/index.php%3FcID%3D71&imgurl=http://www.aipa.ca/files/48311231395313about-us.jpg&w=370&h=247&ei=fOw_UOCJOs7ciQKgylHYDg&zoom=1&iact=hc&vpx=179&vpy=159&dur=609&hovh=183&hovw=275&tx=174&ty=120&sig=109545140025422538381&page=1&tbnh=147&tbnw=196&start=0&ndsp=24&ved=1t:429,r:0,s:0,i:73

Japan

- Agriculture uses nearly 60 billion cubic meters of water
- Extracted from rivers, water is channeled towards paddy fields

http://www.google.ca/imgres?q=japan+rice+paddy&um=1&hl=en&rls=com.microsoft:en-us&biw=1390&bih=821&tbm=isch&tbnid=7-apWnYSLzoelM:&imgrefurl=http://worldkigo2005.blogspot.com/2005/06/fields-paddies-ta.html&imgurl=http://2.bp.blogspot.com/_AdeUgwXpSAM/Sn954wUh6iI/AAAAAAAARK4/A0tO-rLJcBg/s400/tanada01%252BOhaga.jpg&w=400&h=288&ei=1u4_UNW-KcSUiQLMloGACw&zoom=1&iact=hc&vpx=549&vpy=458&dur=125&hovh=190&hovw=265&tx=143&ty=72&sig=113607916428904141566&page=2&tbnh=144&tbnw=176&start=24&ndsp=30&ved=1t:429,r:2,s:24,i:154

What are the benefits of irrigation?

- Increase yield of crop (compared to just precipitation)
- Ability to grow more diverse crops
- Reliability and timing
- 13,000 jobs and $5 billion/year (in Alberta)

http://www.google.ca/imgres?q=alberta+potato&um=1&hl=en&rls=com.microsoft:en-us&biw=1390&bih=821&tbm=isch&tbnid=9a_T7gvXiL-kKM:&imgrefurl=http://www.albertapotatoes.ca/&imgurl=http://www.albertapotatoes.ca/rendition.large-slide/images/feature3.jpg&w=631&h=341&ei=BPU_UJ6VFcLCigLkioHoBw&zoom=1&iact=hc&vpx=556&vpy=166&dur=1887&hovh=165&hovw=306&tx=242&ty=68&sig=113607916428904141566&page=1&tbnh=105&tbnw=195&start=0&ndsp=25&ved=1t:429,r:2,s:0,i:77

http://www.google.ca/imgres?q=sugar+beet&start=118&um=1&hl=en&sa=N&rls=com.microsoft:en-us&biw=1390&bih=821&addh=36&tbm=isch&tbnid=OESHXP4C01CTSM:&imgrefurl=http://www.capitalpress.com/newest/mp-sugar-beet-update-060412&imgurl=http://assets.mediaspanonline.com/prod/3272460/sugar-beet_w500.jpg&w=500&h=320&ei=R_Q_UMySCezsiwKb04DICQ&zoom=1&iact=hc&vpx=597&vpy=478&dur=577&hovh=180&hovw=281&tx=172&ty=113&sig=113607916428904141566&page=5&tbnh=148&tbnw=198&ndsp=30&ved=1t:429,r:8,s:118,i:127

Why Irrigate in Alberta?

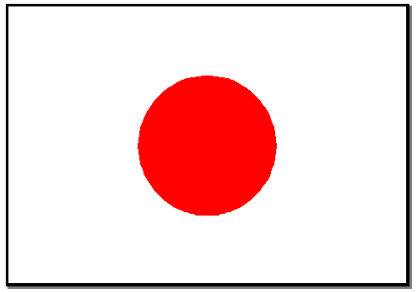
- Low precipitation - 275mm/year
- Clean water source - Rocky Mountains
- Heat units - 2333 corn heat units
- Frost free days - 124 days
- Fertile soil - Dark Brown Chernozem

http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/irr8796

(historical averages for Lethbridge area)

Japanese Rice fields

Soil



- 3 main merits

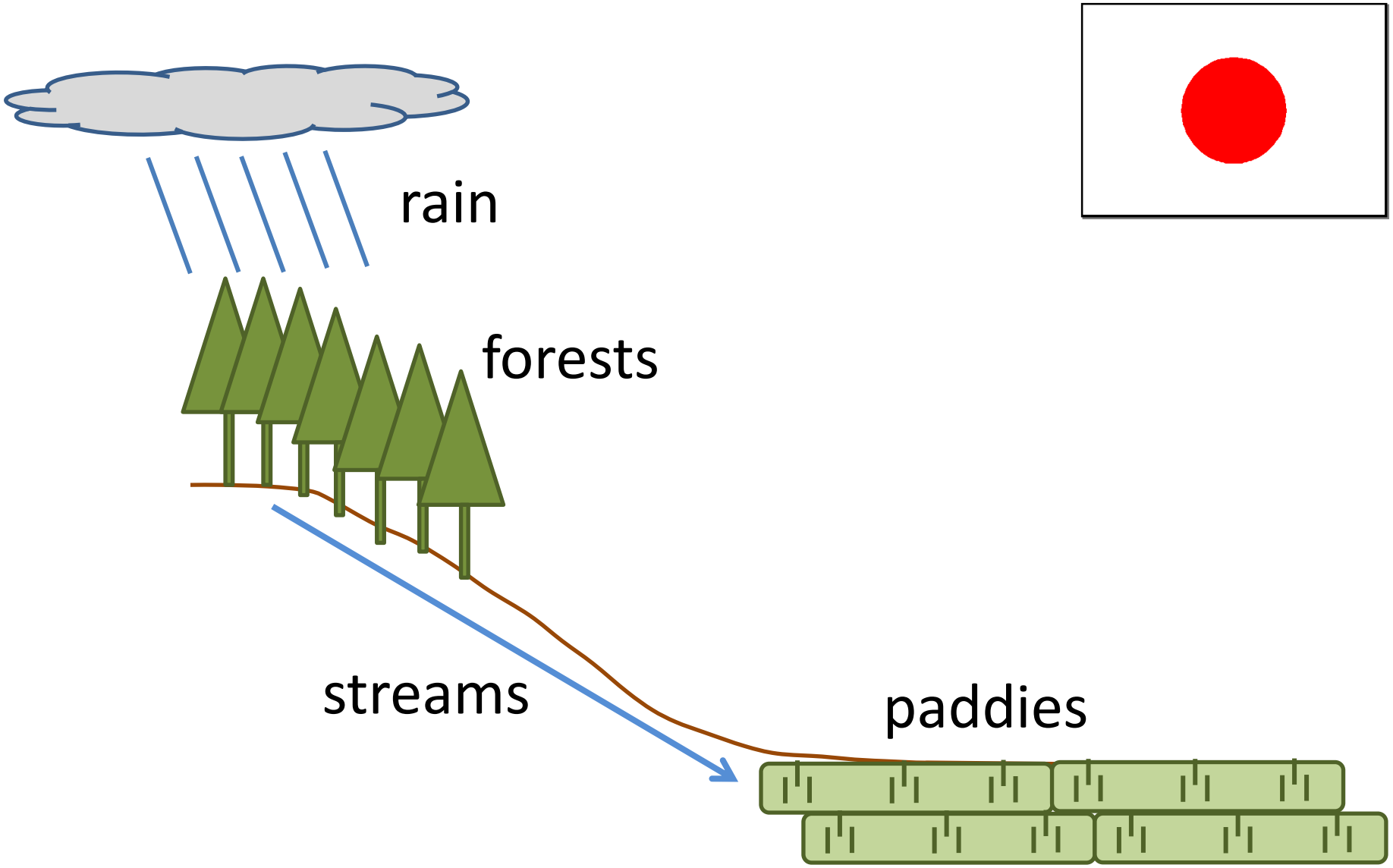
✓ NO erosion

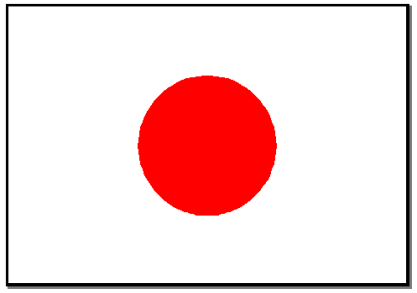
✓ LESS pathogenic microorganisms

✓ NO continuous cropping hazard

That is because...

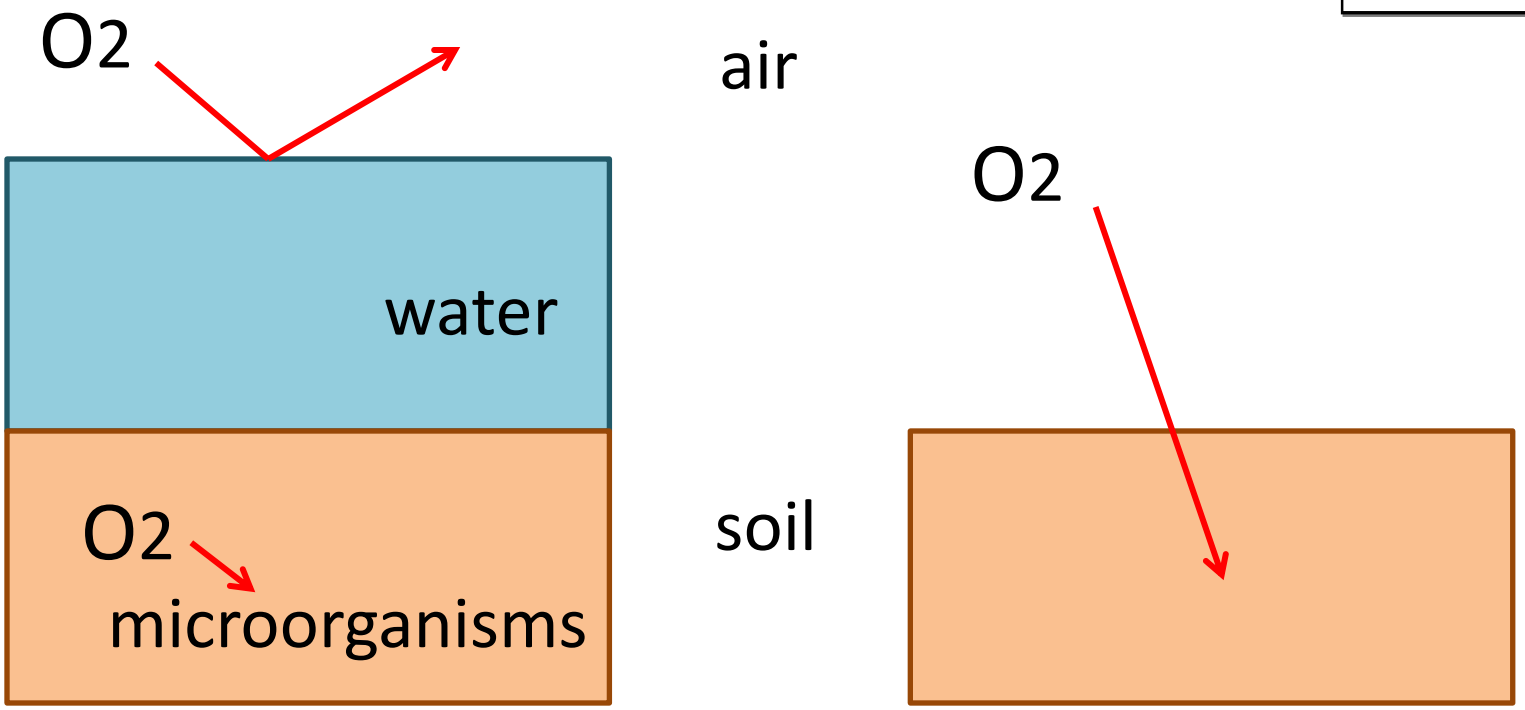
-Water and Nutrition


rain
forests
streams
paddies



irrigation

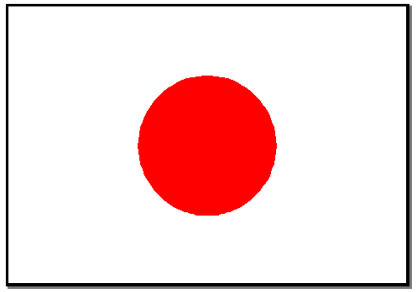
draining



CANNOT supply

CAN supply

Soil



- 3 main reasons

✓ Geographical

Steep Land, Flood, Paddy

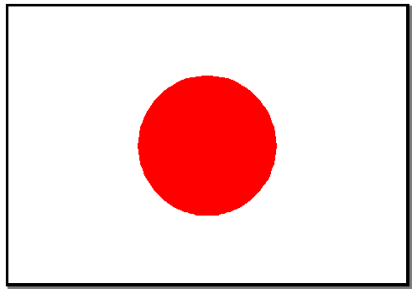
✓ Biological

a cycle of irrigation and draining

✓ Chemical

Oxygen, Nitrogen, Phosphorus

Soil



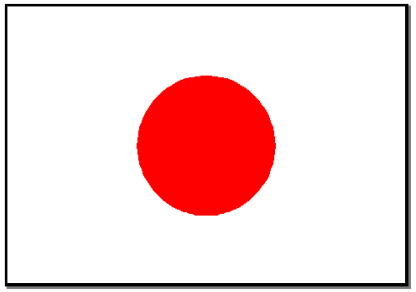
- Demerit

✓ low pH

✓ huge amount of lime

✓ LESS nutrition (in forests)

Irrigation in Japan



-Utilizing slopes of mountains

-Need no pressure

-Irrigation canals

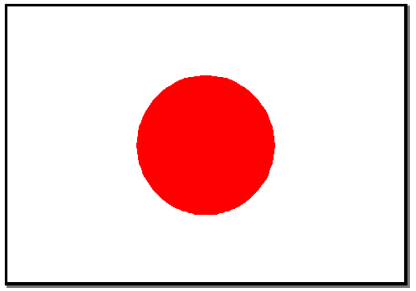
Irrigation canal

-Used not only for agriculture

-Need to be cleaned up regularly

-Maintained by farmers cooperatively

The source of water



-along a big river

River → irrigation canal → fields

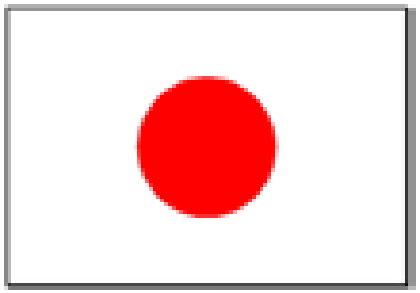
Rain

Mountain

-distant from a river

Reservoir → irrigation canal → fields

The water from mountains



-If there are many trees on the surface ...

:a litter layer can be formed

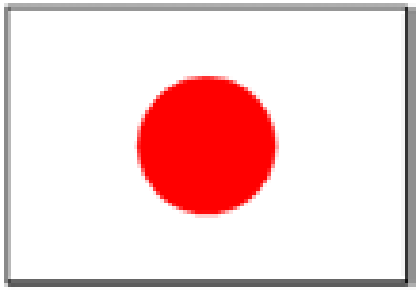
:roots make many pores

:leaves can reduce the speed of rainfall

-If there are few trees on the surface...

:surface runoff occur

Major difficulties of irrigation of Japan



-how to control the amount of water

reservoir

dam

-landslides

What are the current issues with irrigation?

- Unnecessary water diversion
- Runoff and leaching of pesticides
- Snowmelt occurring earlier
- Evaporation
- Improper application- to salty/sandy soil
- Overexpansion due to technology
- Ruts from pivots- water pooling

Problems with Irrigation

- Consumptive use (one time use)
- High water needs
- Not for all fields
- Diversion of water from natural water flows
- Fragmentation of landscape

Information on Alberta Irrigation

- 13 irrigation districts
- 500,000 ha of irrigated land in these districts
- 125,000 ha of irrigated land of private irrigation
- Multiple use (Golf Courses, artificial wetlands, ect)

Information on Alberta Irrigation

- 8 hydroelectric dams
- 2 years worth of storage
- Production can increase 2-3X
- Federal Agreement – 50% of water must pass to Saskatchewan (currently 78%)
- Timothy Production to Japan

What can we do to improve efficiency?

- Use products such as AIMM to minimize excess water taken
- Designed to help producers make irrigation scheduling decisions
- Simulates growing conditions and assists farmers in managing the timing and amount of water application

http://www.agric.gov.ab.ca/app49/imcin/aimm-help.pdf

What can we do to improve efficiency?

- Underground water pipes to reduce evaporation, leaching, and fragmentation
- Reservoir tillage to minimize runoff
- Management of ruts from pivots

http://www.google.ca/imgres?q=pvc+pipe&um=1&hl=en&sa=N&rls=com.microsoft:en-us&biw=1390&bih=821&tbm=isch&tbnid=B5_pq8dVt9-fvM:&imgrefurl=http://theplasticpipeshop.wordpress.com/&imgurl=http://theplasticpipeshop.files.wordpress.com/2012/07/pvc_pipe_2.jpg&w=1237&h=828&ei=2QFAUJivJqiciQK9iICoDw&zoom=1&iact=hc&vpx=1068&vpy=371&dur=421&hovh=184&hovw=275&tx=244&ty=75&sig=113607916428904141566&page=1&tbnh=134&tbnw=177&start=0&ndsp=28&ved=1t:429,r:20,s:0,i:201

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Conclusion

- Pro's and Con's to all systems
- Proper management and education
- Integration of ideas
- Research

- Recognize the limits of the land
- Constant balancing act between nature and human technology

http://www.google.ca/imgres?q=rangeland&um=1&hl=en&rls=com.microsoft:en-us&biw=1390&bih=821&tbm=isch&tbnid=PB-MdE4Wr4RQ-M:&imgrefurl=http://www.rangelandconsultants.com/&imgurl=http://www.rangelandconsultants.com/Bmartr2.JPG&w=576&h=391&ei=vARAUJSDD-GgigLav4BQ&zoom=1&iact=hc&vpx=362&vpy=518&dur=1388&hovh=185&hovw=273&tx=186&ty=123&sig=113607916428904141566&page=3&tbnh=137&tbnw=179&start=52&ndsp=31&ved=1t:429,r:1,s:52,i:241

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Thank You for Listening!

The Interaction of Wildlife and Cropland

Ryosuke Kida
Kenji Takagi
Jean Yang
Diana Laviolette Brown

Contents

1. INTRODUCTION

- The development of cropland interferes with native habitat for wildlife. We will explore this relationship and outline some general solutions.

2. NATIVE ANIMALS

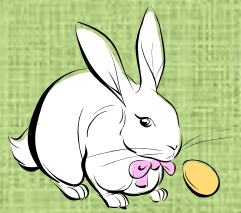
Native Animals

- In AB, 587 native species, 93 mammals, 411 birds, 65 fish and so on.
- Nature ways of controlling pests :

  predator v.s. pests

Common Pests

- Pests: Animal found in abundant numbers in an area it is not wanted
- In Alberta, the most common burrowing rodent animal pests on crop land are :
  - I. Richardson' ground squirrels
  - II. Pocket gophers
  - III. Voles (a.k.a field mice)
- Other pests include:
  - IV. Skunks
  - V. Hares



I. Richardson's Ground Squirrels

- AKA 'gophers', found in many areas throughout Alberta.
  - Most common form of ground squirrel in the province.
  - Major food source for badgers which can damage fields when digging for ground squirrels.
- Roles: important in local ecology , since they are part of the diet for a number of predatory animals such as badgers, and foxes.

II. Pocket Gophers

- They live in a burrow system that can cover an area of 18 to 185 square meters.
  - are built for digging and tunneling with powerful shoulders.
  - Also controlled by several natural predators from owl and hawks.
- Pocket Gophers eat stems and leaves in summer and spring, roots and other plant parts in fall and winter.

III. Voles (Mice)

- Voles tend to live when settlement and agriculture exist and agriculture exist and may give infested premises a distinct rodent smell.
  - Climb about and under structures looking for food and places to habitat.
  - They tend to chew, causing physical damage, as well as contaminate the areas they investigate with urine and feces.

IV. Skunks

- “striped skunk”, varies in length from 50-95cm, and similar in size to a house cat.

- Behavior:
  - not a social animals,
  - eats both plants(flowers) and animals.
  - Adapt well to urban and rural areas, living under sidewalks, decks, building and brush piles.
  - They stinks !!!!!

V. Hares

- Hares mainly live in the County of Strathcona, and prefer a habitat that contains dense stands of woody shrubs.
  - eat broad-leaf plants and grasses.
- When green vegetation is unavailable(winter), they will change to browsing on buds, bark and small twigs.
- Hares gnawing on the bark of woody plants can be a cause of plant mortality.

3. CROPLAND

Cropland

- Millions of acres in production across prairies
- Primarily mono-culture fields designed for ease of production

Production

- The land must be altered in order to become efficient for production

4. PROBLEMS

Problems: Richardson's Ground Squirrels

- High population creates serious problems in our rural areas, they:
  - Compete with livestock for forage
  - Destroy food crops
  - Weaken ditch banks (making them unsafe for farm machinery)
  - Can damage haying machinery
- Population is naturally taken care of by predators but sometimes lethal control is necessary.

Population Dynamics: Predators

- Populations have decreased
  - Subdivision of land or native roaming area
  - Unchecked hunting after settlement
  - Low reproductive capacity

Population Dynamics: Pests

- Populations have increased
  - Decreased predation
  - Vigorous reproduction

Invasion Into Agricultural Sphere

- Encroachment into habitat forces native species to forage in areas of production

5. SOLUTIONS

Historically

- Provincial and federal government legislation
- Distribution of hunting licences
- Educational initiatives and programs

Marginal Land

- Use for rangeland or alternative use programs
  - Ex. Saskatchewan woodlot program

Creating Natural Areas

- Leaving habitat intact for wildlife respite and population growth in predatory species

Educational Programs

- Workshops and reliable information to inform producers about all the options and implications concerning the use of land that is being continually developed

6. CONCLUSION

- By being aware and proactive with land management we can reduce incidence of interaction.

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Alberta National Parks

ALES 291 - Kira Macmillan, Shuma Makino, Lewis Fausak , Chisa Shimazato

http://www.1000lonelyplaces.com

Parks Canada

- A branch of the federal government
- Protect and present Canada's natural and cultural heritage
- 44 national parks

Banff National Park

- First park created in 1885
- 6641 square km
- Contains the town of Banff
- Around 3 million visitors a year

Banff

Lake Louise

Jasper National Park

- Established in 1907
- 11228 square km
- Contains the town of Jasper
- Most easily reached glacier in North America
  - Athabasca Glacier

Jasper

UNESCO

- United Nations Education, Scientific, and Cultural Organization
- Establish world heritage sites
  - Cultural or physical significance
- Banff and Jasper national parks

  make up part of the Rocky Mountain

  world heritage site




Wildlife Management




Goals

- Preserve ecological integrity
  - Maintain natural processes
- Public understanding and appreciation
  - Education and experience
- Maintain for future generations

Issues

- Habitat fragmentation
- Tourist interference with animals
- Species at Risk

Habitat Fragmentation

- Highway fencing divides land and animal populations
  - Genetic isolation
- Create over and underpasses to connect both sides of the highway
  - Track animal crossings and so far very successful
    - 200 000 crossings

Tourist Interference

- Tourists try to interact too much with animals
- Animals become habituated with people
- Safety concern
  - Still wild animals and can attack

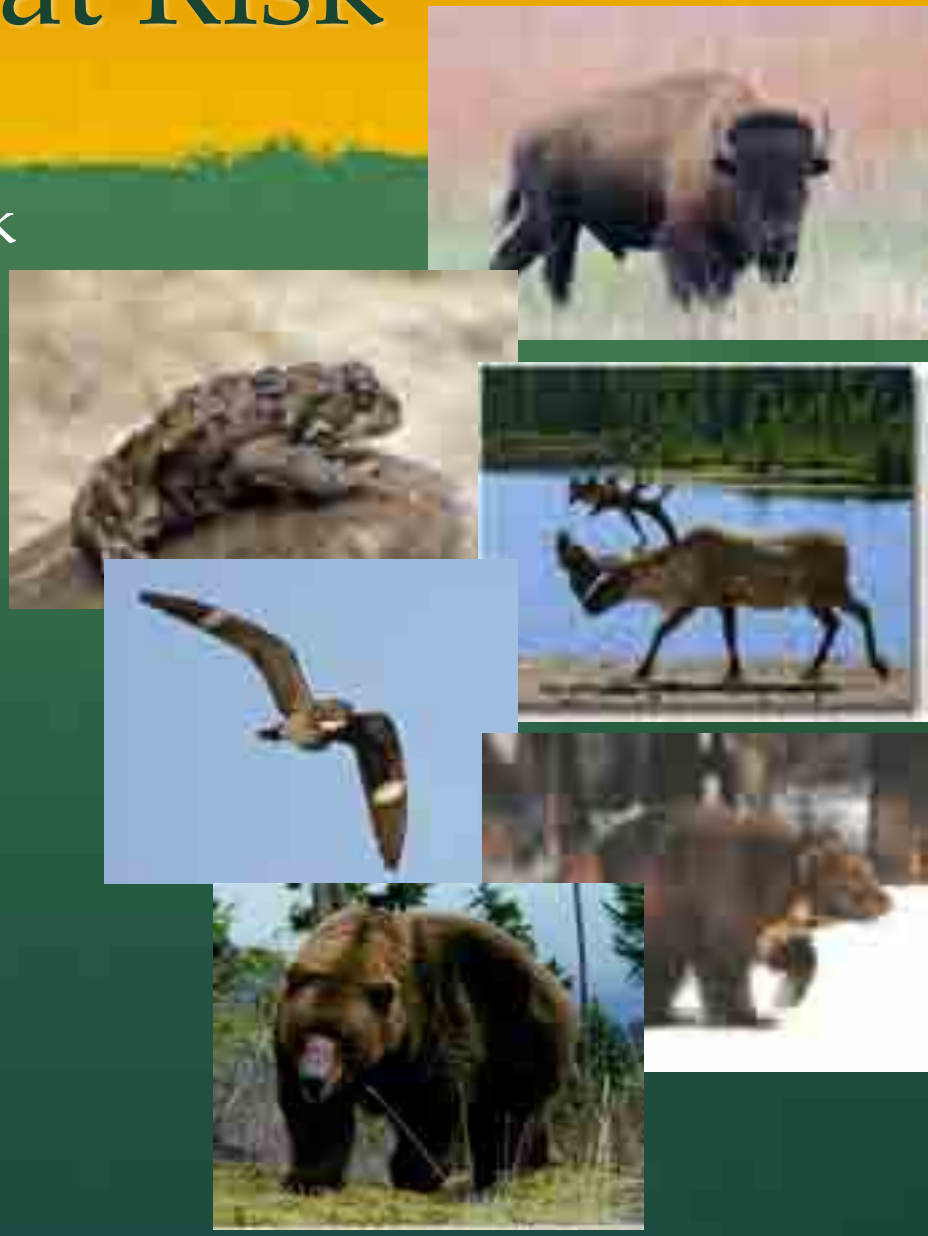
Species at Risk

- Species that have to be managed in order to prevent extinction
- Over hunted
- Usually more sensitive life history
  - Low birth rate
  - Specialized habitat
  - Late age of maturity

Species at Risk

Jasper and Banff National Park

- Plains Bison
- Western Toad
- Woodland Caribou
- Common Nighthawk
- Wolverine
- Grizzly Bear



Wildlife in Canada

Examples:

- Grizzly Bear
- Black Bear
- Polar Bear
- Kermode Bear
- Musk ox
- Wolf
- Caribou

Considering the environmental problems in parks, our most pressing need right now is wildlife protection.

→ Bears

Bears in Banff and Jasper National Parks

Grizzly Bear

- Big shoulder
- Longer claws
- Scooped nose
- Short round ears

Black Bear

- No hump
- Shorter claws
- Straight nose
- Skinny ears

Preservation

The main cause of death among bears is being run over bears on roads and railway

- Biorhythm of a crop yield in forest
- Stress from human intervention

countermeasures

barriers, fences, underpasses, overpasses

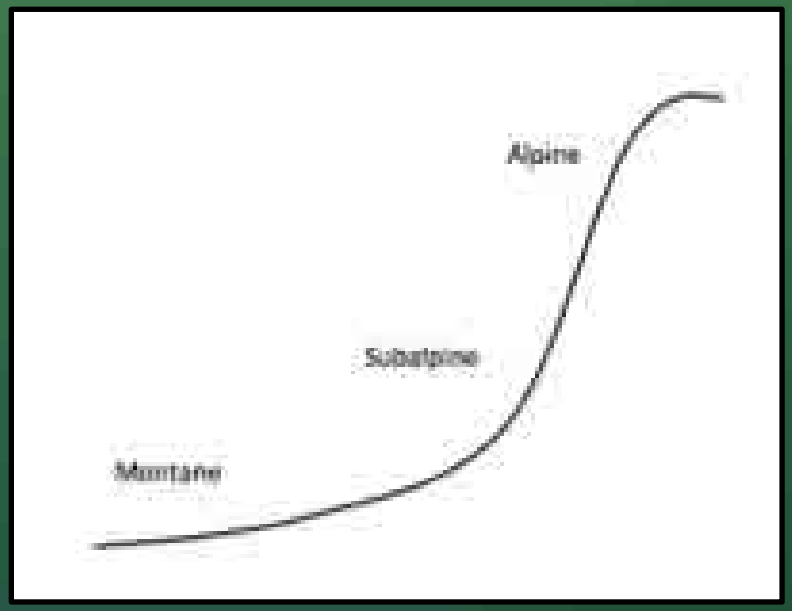
Considerations

- Possibility that Japanese imports of woods from Canada destroys Canadian ecosystem
- Importance of biodiversity protection to preserve life
- Mutual cooperation with human and wildlife, not one-sided protection

Forests of Jasper and Banff National Park

There are 3 major eco-regions that are found in Banff and Jasper National parks, they are;

1) Alpine → this covers approximately 42% of the landscape. This includes land above the tree line, which mostly consists of rock and ice.
2) Subalpine → covers approximately 55% of the landscape. This area is above the valley but below the treeline. It includes sloped forests and meadows.
3) Montane → covers 3% of the landscape, it is where most large animals occur, as well as most human use occurs. It is the valley bottoms, which provides the most productive habitats in the park.



Source Duncan Bayne – Parks Canada

Special Areas of Concern

- Within Banff and Jasper National Parke there are two areas of special concern, they are:
  - Whitebark pine tree
  - Mountain pine beetle

http://www.pc.gc.ca/pn-np/mtn/feuveg-fireveg/veg-veg.aspx

Whitebark Pine

- The whitebark pine tree grows in the cold subalpine eco region of the parks.
- Is provides key ecosystem functions such as: reducing snowmelt by retaining snow, stabilizing soils, facilitates succession, and providing a food source to animals.

http://www.pc.gc.ca/pn-np/mtn/feuveg-fireveg/veg-veg/pin-pine.aspx

http://en.wikipedia.org/wiki/Grizzly_bear

http://en.wikipedia.org/wiki/Grizzly_bear

http://en.wikipedia.org/wiki/American_red_squirrel

http://en.wikipedia.org/wiki/Clark's_Nutcracker

Special Concerns

http://www.fs.fed.us/rm/highelevationwhitepines/Threats/blister-rust-threat.htm

- Reduction in numbers due to:
  - Climate change
  - Fire exclusion
  - Mountain pine beetle
  - White pine blister rust brought from Europe in 1600's
- Efforts to mitigate the reduction include:
  - Breeding programs to select for white pine blister rust tolerant plants
  - Cages around cones to preserve seeds
  - Possibly presrcibed fire will open up the canopy

Source: John Wilmshurt – Parks Canada

Mountain Pine Beetle

- Mountain pine beetle is an invasive native species that can potentially have damaging effects on forests in Banff and Jasper National Parks.
- The beetles target larger mature trees that have less sap. A younger healthy tree will be able to push the beetle out of the tree with sap.
- The beetle eats through the bark and lays it's eggs. When the eggs hatch, the larvae work into the phloem, then in a circular fashion around the phloem, producing a girdling effect which kills the tree.

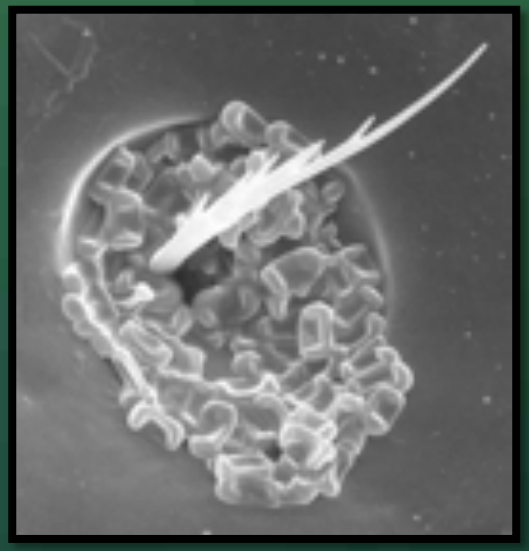
Source: John Wilmshurst – Parks Canada

http://www.pc.gc.ca/pn-np/mtn/feuveg-fireveg/veg-veg/dpp-mpb.aspx

Blue Stain Fungus

- The mountain pine beetle also brings in with it a fungus called blue stain fungi. This fungi clogs the phloem which makes it harder for the tree to pitch the beetles out.
- The fungi and beetle together cut off the flow of water and nutrients in the plants.

http://www.pc.gc.ca/docs/v-g/dpp-mpb/sec3/dpp-mpb3a.aspx



http://www.pc.gc.ca/docs/v-g/dpp-mpb/sec3/dpp-mpb3a.aspx

Mitigation of Mountain Pine Beetles

- There are three forms of mitigation:
  - The main form of management of mountain pine beetles is fire. Fire helps produce younger and more varied vegetation that the beetles cannot easily attack, it also kills beetles in that area.
  - Infested trees can be cut and removed from the site. Thus eliminating the beetles present in that tree.
  - Pheromone baiting can also be used to concentrate beetles to certain areas of the park.

Vegetation Management

- There are three different ways that forests and vegetation are managed in the parks;
  - Controlling non-native weeds
  - Re-vegetating disturbed areas with native plants
  - Prescribed Fires

Non-native Weed Management

- Non-native weeds are those that are not normally found in the area. These plants can be highly invasive as they often do not have any natural predators and can produce many seeds. They can reduce the ecological integrity of the parks.

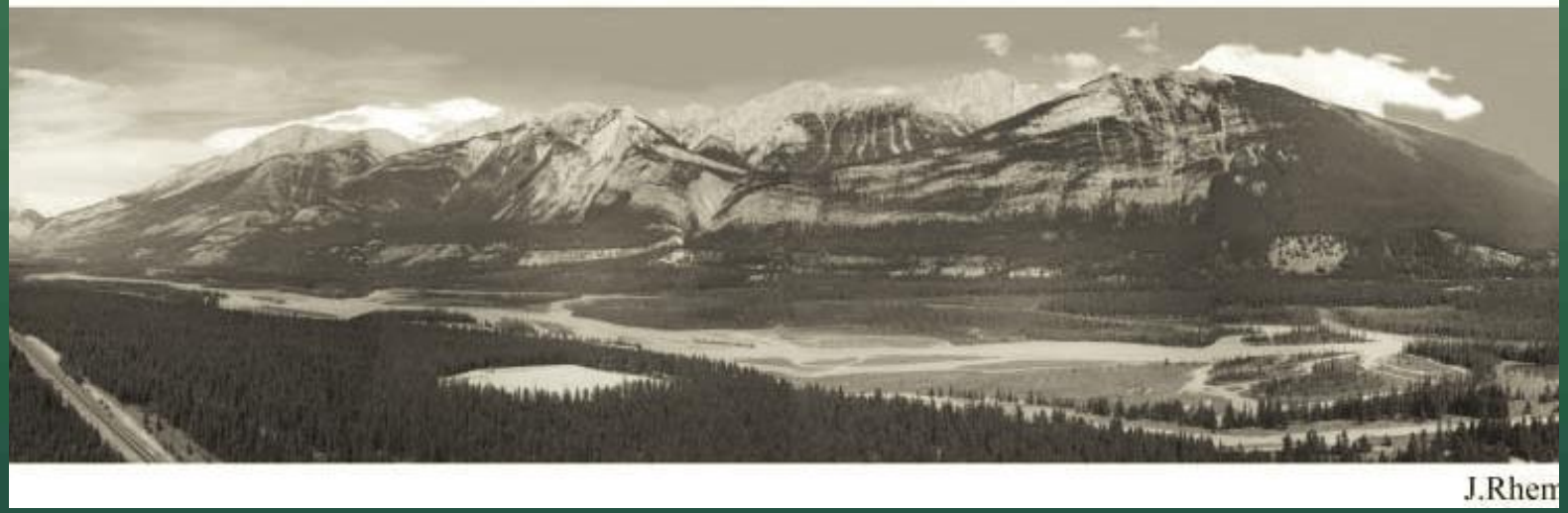
- In order to mitigate non-native weeds, Parks Canada has developed an integrated pest management program. This involves:
  - Mechanical controls - removal of weedy species by machine or hand.
  - Biological controls – removal of weeds by introducing natural predators.
  - Chemical controls – use herbicides to reduce amount of weeds to a level where mechanical removal is possible.

Forest fire management

In Banff national park

1915

1998



Why is fire necessary?

Old forests

- More litter (logs, leaves, needles…)
-Increased chance of uncontrolled fire
-Closed canopy
-Increased soil erosion
-Lower biodiversity

Grasslands

-Mineral-rich ash

-Open gap

-High biodiversity

produce a mosaic of plant communities of different ages and species

Fire management

- Monitor and evaluate progress
- Fire controls - divide park forests into three different areas by human uses:
  - Deep forest area… if a fire occurs, leave a fire and just watch
  - Middle area… leave a fire, but prevent to get into Human use area
  - Human use area… extinguish a fire immediately
- Prescribed burn – a man-made fire used to burn an area in order to:
  - Restore ecological diversity, create a safe area, reduce fuel load, for scientific research, and to create food and habitat for wildlife.

Four Main Fire Adapted Species in Banff National Park

- **Douglas fir**

Because of it's thick bark, a fire that burns ¾ of it's bark, will not be sufficient to kill the Tree.

- **Aspen**

Aspen grows from singular root system, so it regenerates from roots after fire.

- **Lodgepole pine**

Lodgepole pine burns well.

its cones release seeds in fire, and

grow up rapidly after fire has occurred in the area.

- **White spruce**

White spruse also burns well,

it helps perpetuate fire, and allows

it to reach the forest canopy.

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Is Organic Farming a Sustainable Agricultural Practice?

Kyoto Exchange 2012

Leah Predy
Takayuki Yamashita
Yuri Tanaka
Anna Kauffman

Sunshine Organic Farm

- Pasture raised beef, pork, chicken, and turkeys
- Free run eggs
- Certified through Global Organic Alliance
- Fed organically grown grains and hay (grown on-farm), free of hormones, chemicals, and other additives
- Beef is from a closed herd. Only bulls are purchased
- Chickens and turkeys are raised outdoors in warm weather, and are in a large barn in bad weather

Poultry Breed Selection

Intensive systems:

- Low days until slaughter (41)
- Standard breeds, such as Ross or Cobb chickens
- Rapid weight gain required
- Heart attacks and leg problems due to rapid weight gain, making them unsuitable for organic systems

Organic systems:

- Longer days before slaughter (81)
- Slow growing (do not have a feeding regime that pushes the bird to gain weight)
- Wide variety of breeds produce many flavours and varied feather colour
- Hardy nature to withstand outdoor exposure
- Sunshine Organic Farm: Feed organically raised grains grown on-farm

Pig Breed Selection

Intensive systems:

- Typically have animals confined on concrete flooring or metal grating, so breeds with strong legs and feet are selected

- Breeding aimed at high performing, productive reproducers

- Major breeds in Canada:
  - Yorkshire
  - Landrace
  - Duroc
  - Hampshire
  - Lacombe

Organic Operations (Sunshine Organic Farm):

- Raised outdoors
- Free of hormones, antibiotics, chemicals, and growth additives
- Berkshire or Landrace
- Berkshire: high milk production, good mothering abilities, thrive in pasture setting
- Landrace: good meat production, high milk production, good mothering abilities

Other Sustainable Efforts:

- Conversion to solar power. Next year, hope to have 70% of farm on solar power

- Wood-burning stove to heat most of the farm buildings

- Straw-insulated chicken barn with outdoor access

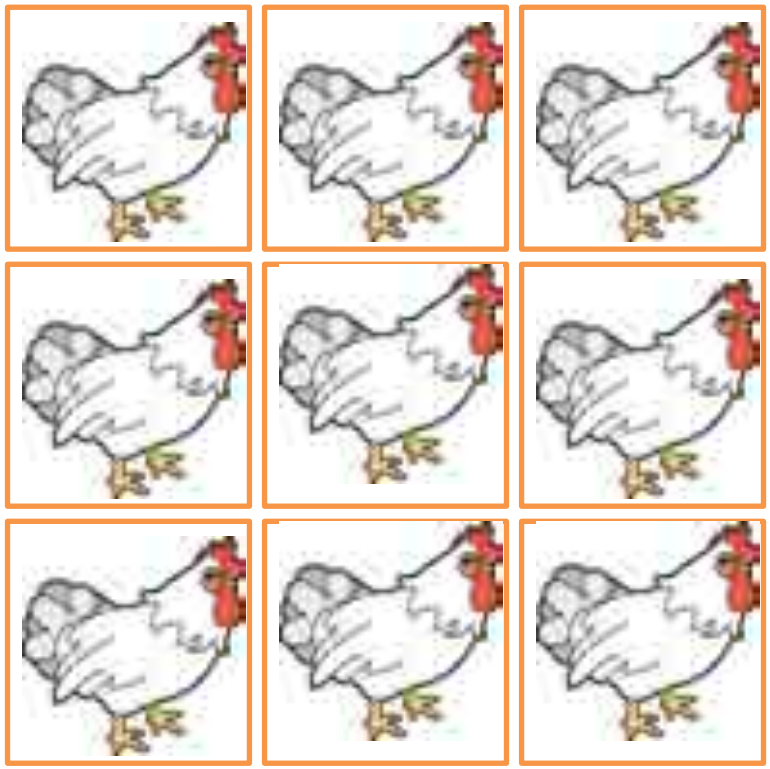
Meat production and processing

Takayuki Yamashita

Sunshine Organic Farm

Chickens

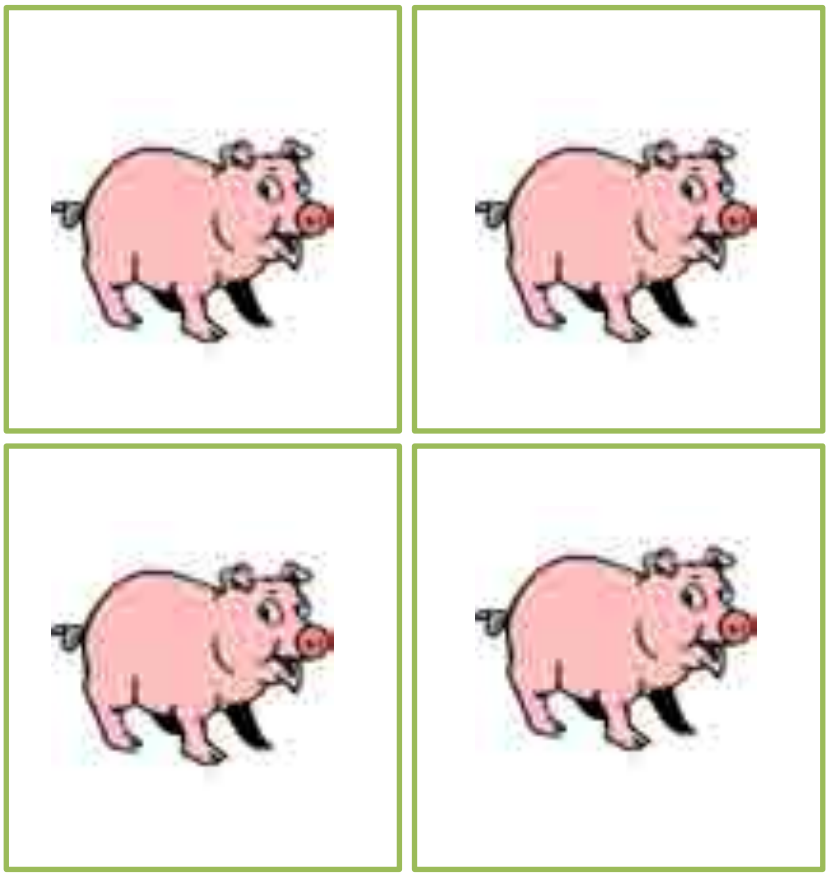
Conventional Farm



Organic Farm

Pigs

Conventional farm



Organic Farm

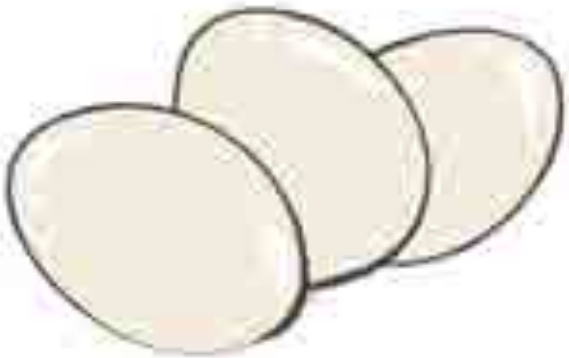
Organic Farming

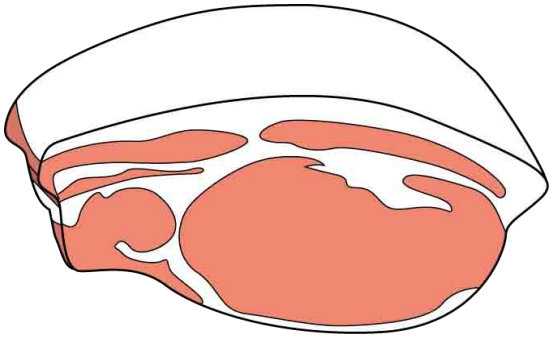
- The Organic farming method came from Europe.
- Organic farming was built on the concept of animal welfare.
- One concern with organic farming is disease, which may infect both humans and animals.

  →And the fact that organic farming may impact domestic animal's health.

Organic Farming

Healthy animals can give us quality meat, eggs and milk.





Meat Processing

Meat Processing Facilities

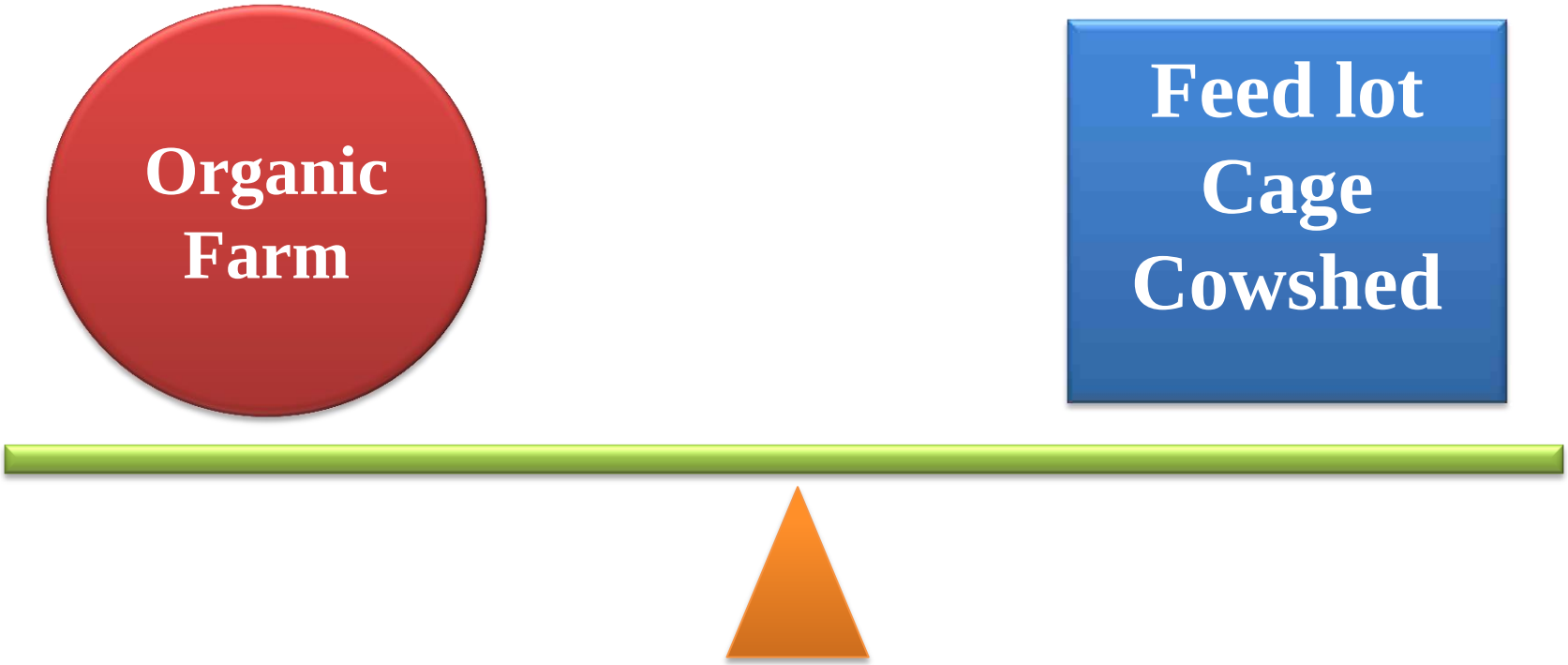
Meat Processing

Large Cold Storage

Problems with Organic Farming

1. Organic farming requires great care.
2. The farmers need a large area to keep a small number of domesticated animals.
3. The price is high.

Balancing organic farming and traditional farming



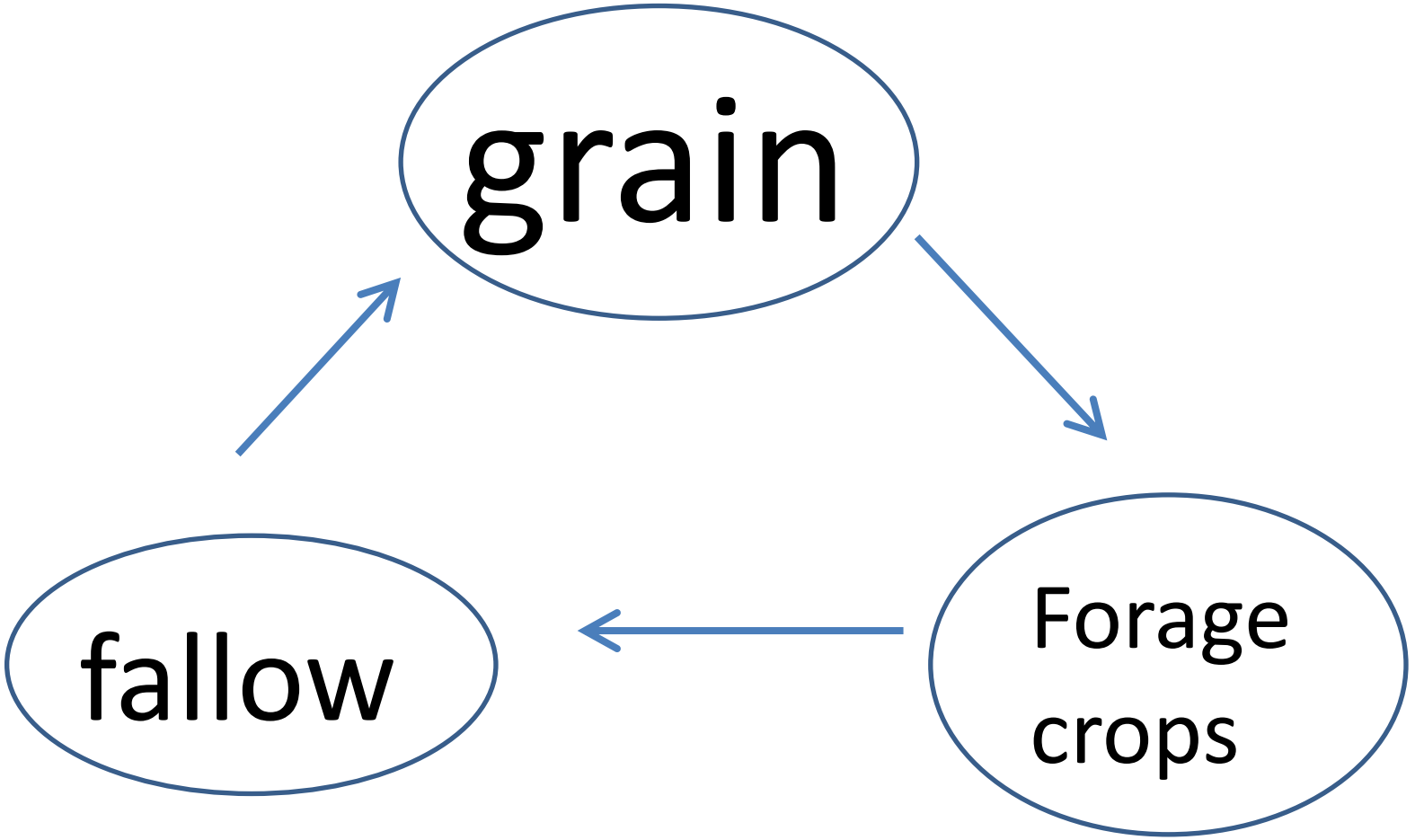
Organic crop production

- weed management
- management of soil fertility
- giving competitive traits

Methods

- Crop rotations
- Crop mixtures
- Selection practice
- Increased seeding rates
- Tillage
- Organic materials

Crop rotations



Methods

- Crop rotations
- Crop mixtures
- Selection practice
- Increased seeding rate
- Tillage
- Organic materials

Selection

Barley field

Methods

- Crop rotations
- Crop mixtures
- Selection practice
- Increased seeding rate
- Tillage
- Organic materials

Tillage

+

Non-chemical methods

- Cover cropping
- Unseeding
- Green manures

Methods

- Crop rotations
- Crop mixtures
- Selection practice
- Increased seeding rate
- Tillage
- Organic materials

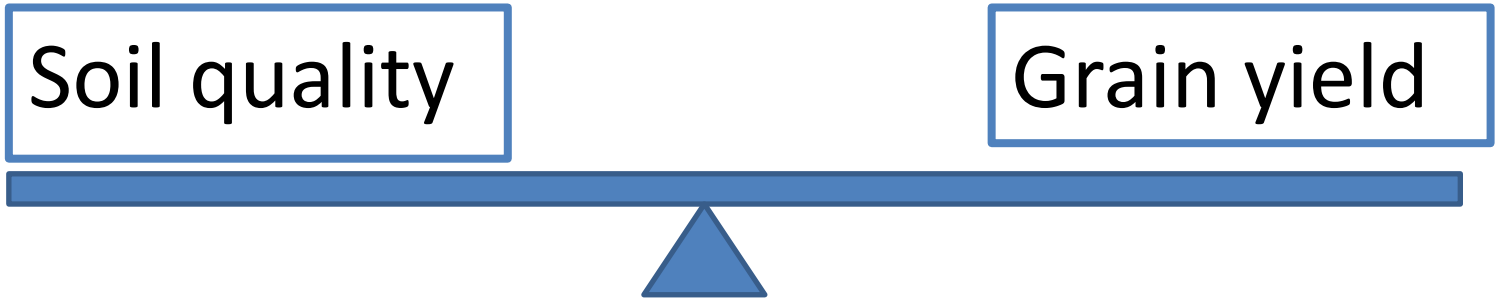
Conventional systems (synthetic inputs)

- Reduced ground and surface water quality
- Crop pest problems
- Inefficient energy use
- High input costs

not sustainable

Organic crop production

Balance between maintaining soil quality and grain yield is important.




Organic Agriculture

ENVIRONMENT

- Minimizing the need for inorganic fertilizers
- Reducing carbon emissions
- Reducing waste

TILLAGE

- There are several methods for reducing tillage in organic farming

SOCIAL CONSEQUENCES

- Intensive Feedlot operations can have negative consequences on rural communities
- Organic Farming, when consolidated, can have damaging consequences on rural places

ANIMAL WELFARE

ECONOMICS

- Organic Agriculture must remain a perceived `healthier` choice than conventional food products in order to maintain a higher price point
- Capital Costs can be high with organic approach
- Increased demand can have negative consequences with this niche market
- Profitability is high and output can be similar

THANK YOU!

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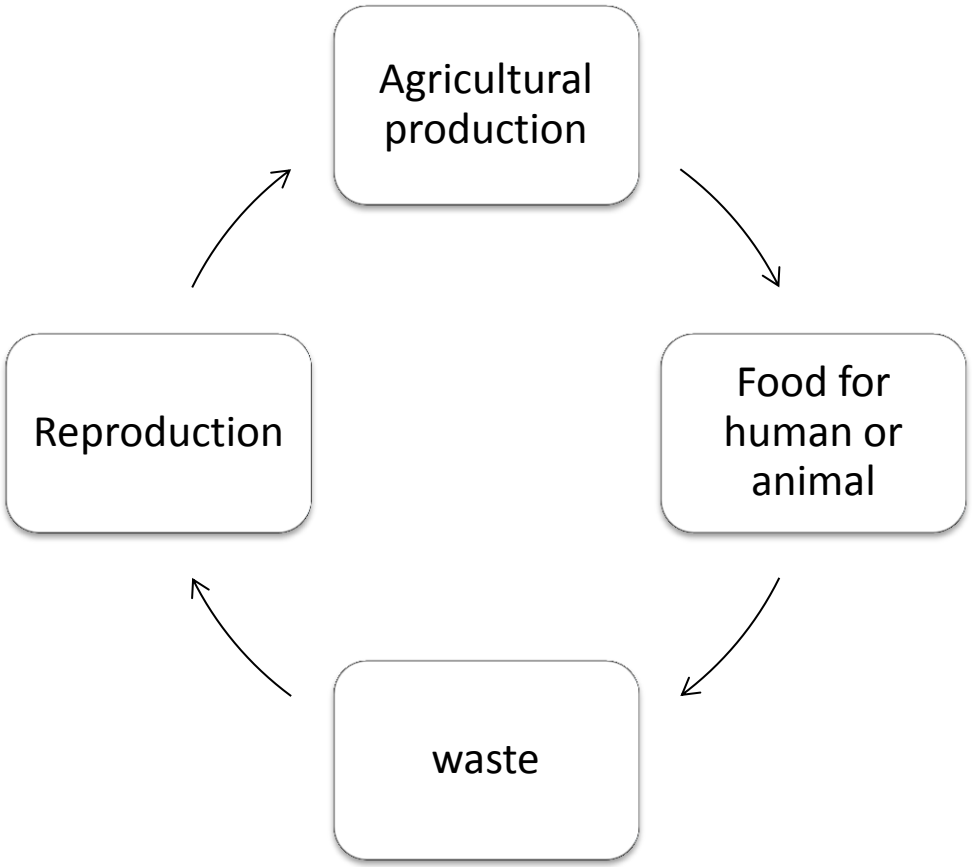
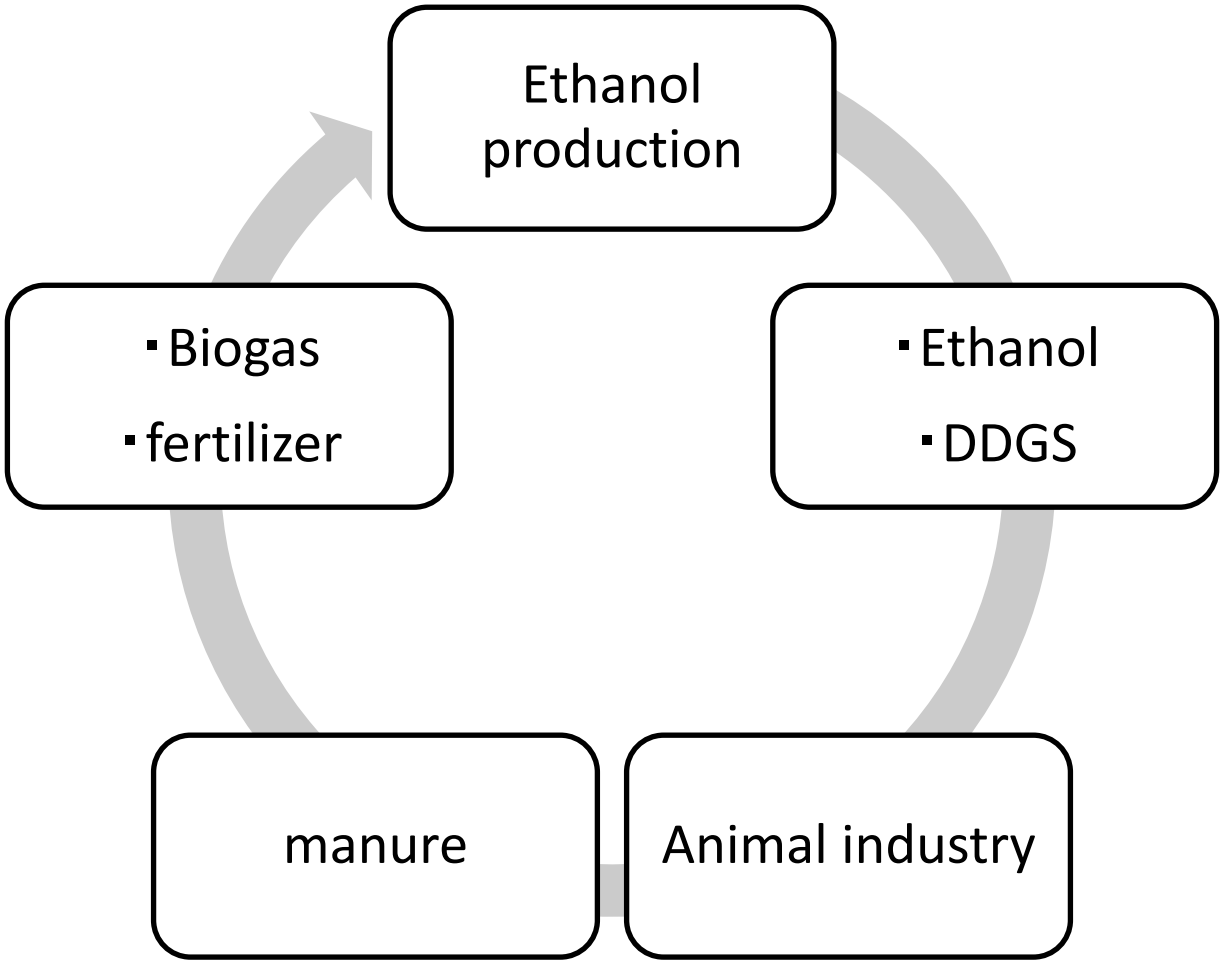
The earth is very beautiful…..

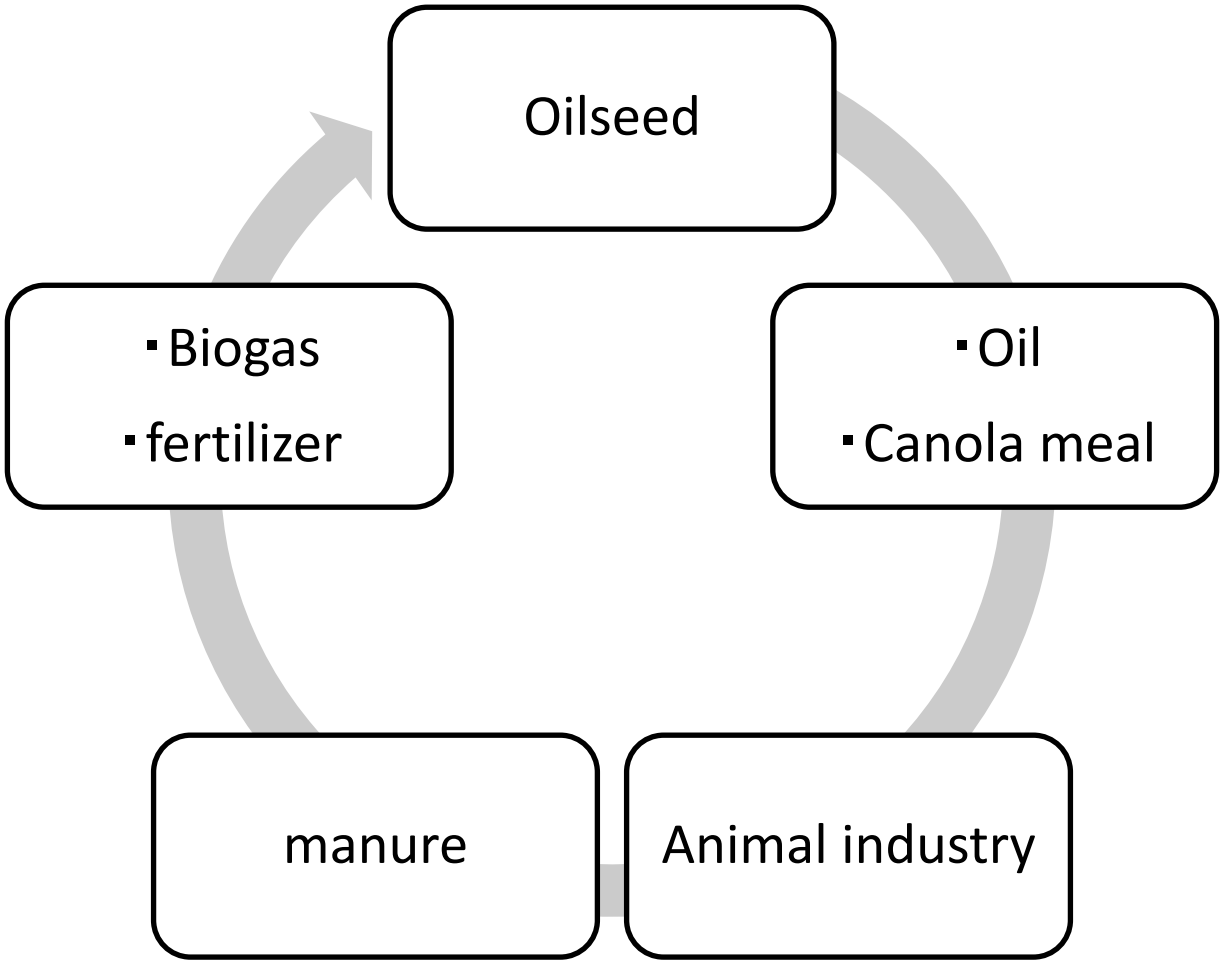
Circulation of sustainability



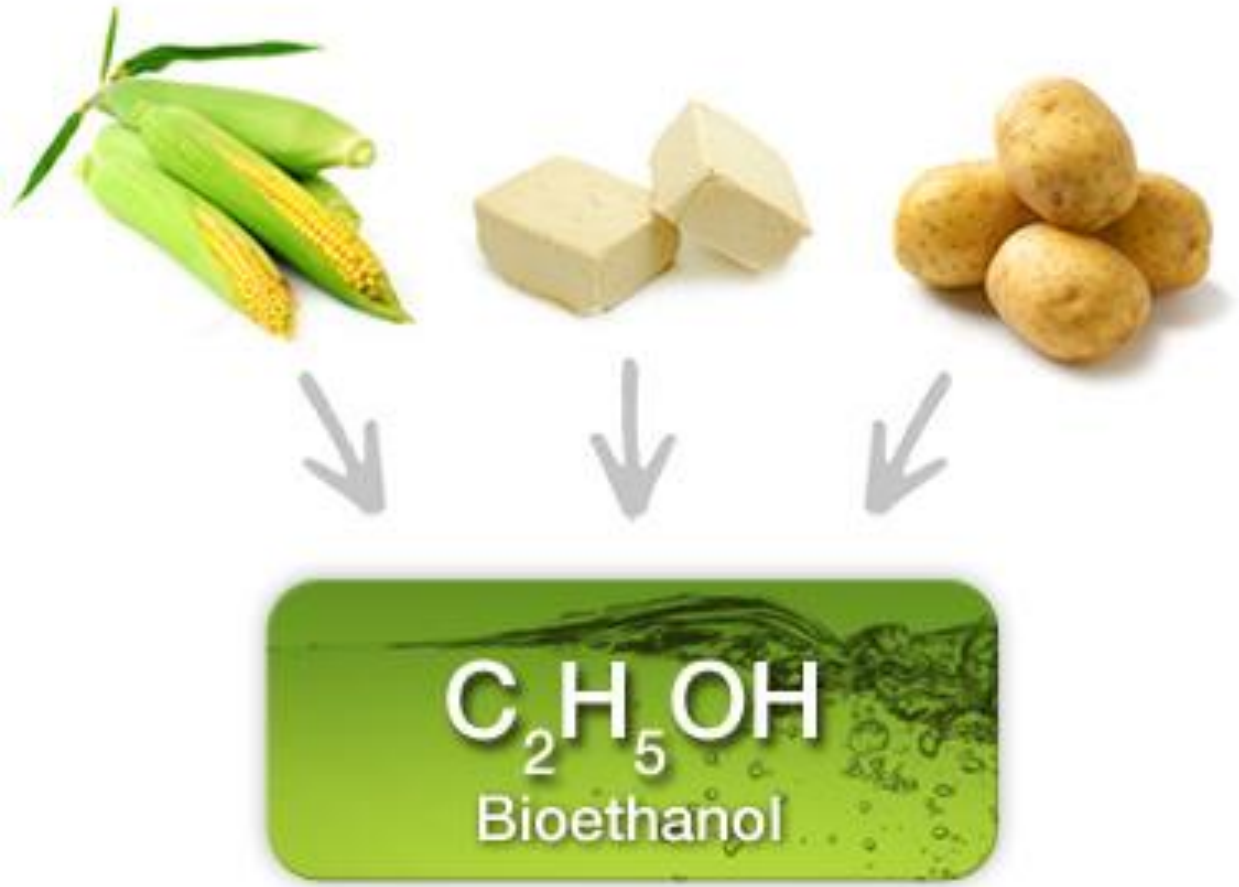
Specific example



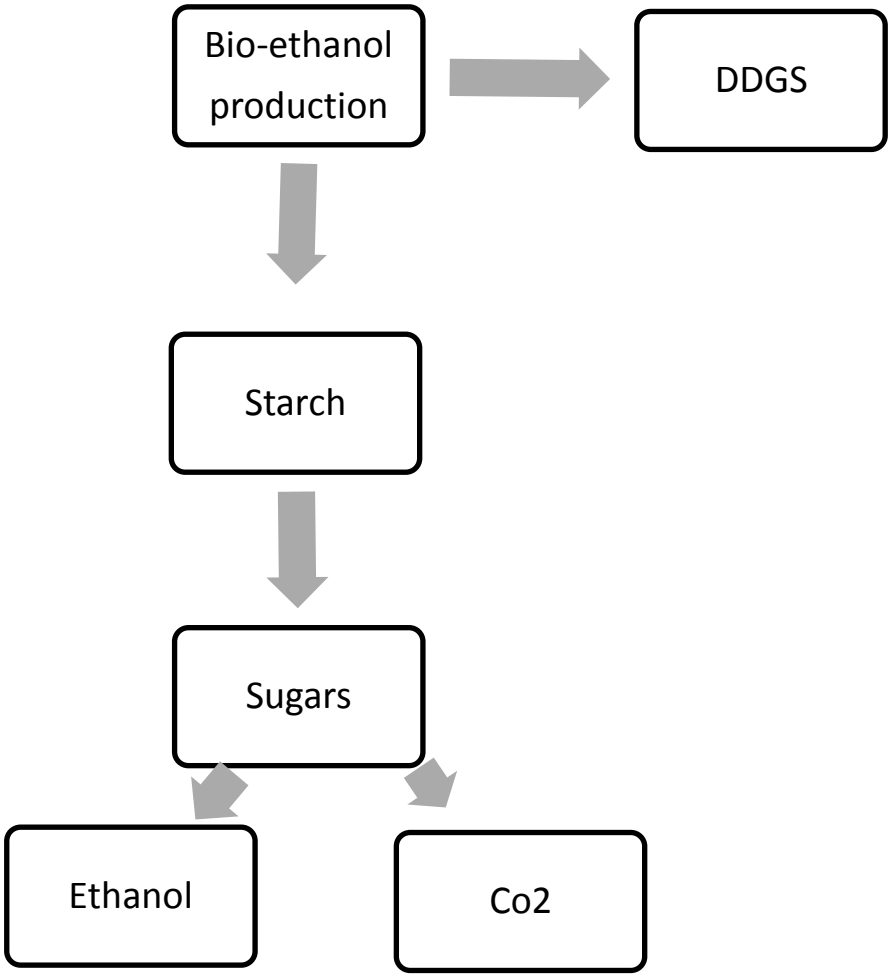
Specific example



Bio-ethanol



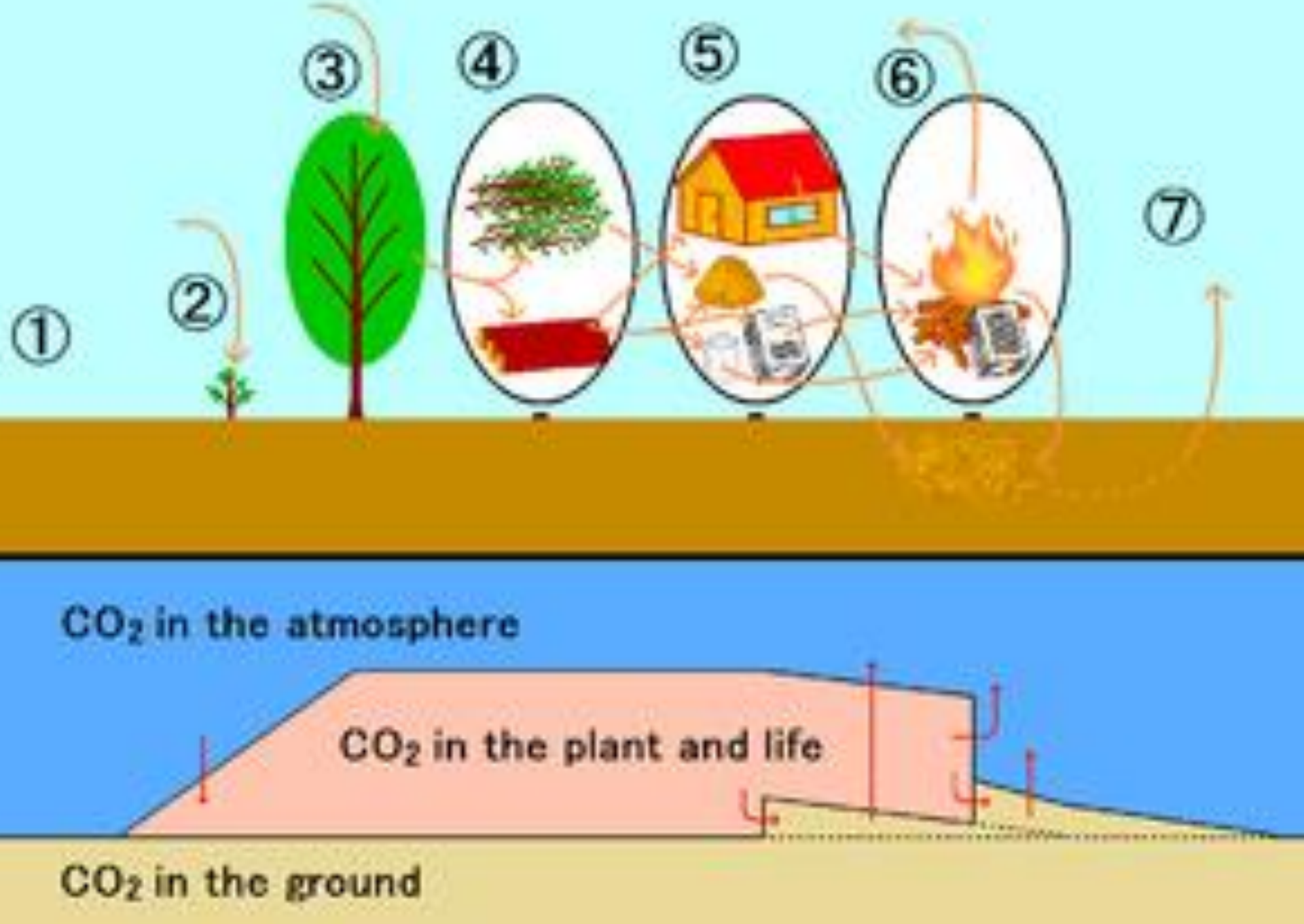
Bio-ethanol



Advantages

①Bio-ethanol is sustainable energy because it is made from reproductive production such as biological(plants) resources.

②Bio-ethanol does not increase the absolute amount of carbon dioxide.(Carbon neutral)


①
②
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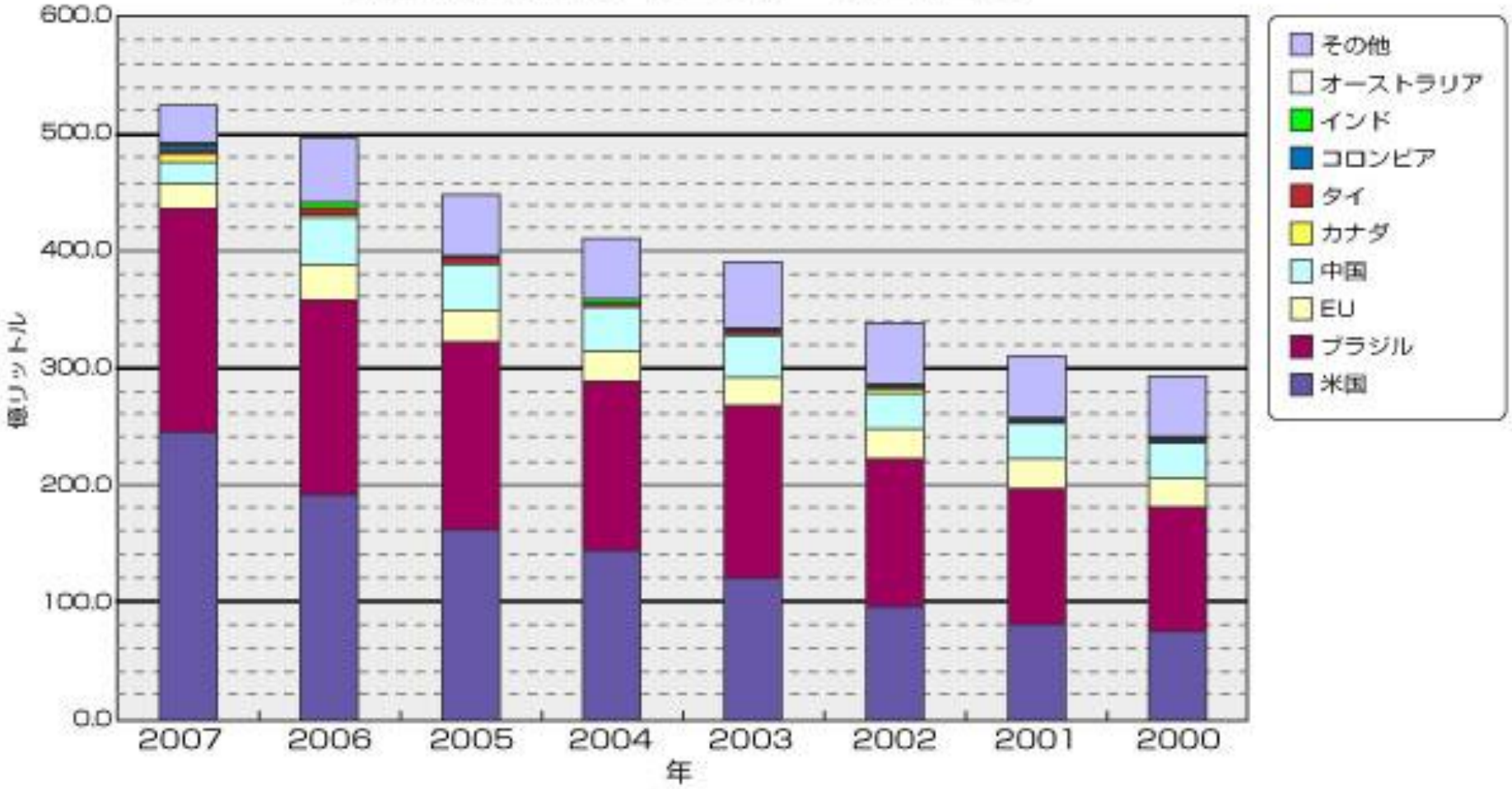
CO_2 in the atmosphere
CO_2 in the plant and life
CO_2 in the ground

世界各国のバイオエタノール生産量



Problems

1.Ethical problem

The more and more farmer make Bio-ethanol productions due to increase in prices of them.

2.Possibility to destruct environment

Cultivation of Bio-ethanol productions is widely and rapidly spread, which cause environmental destruction because of uncivilized cultivation and cutting trees.

3.Oxidization

It has ability to oxidize metal. So it is difficult to use it entirely with metal material such as car engines.

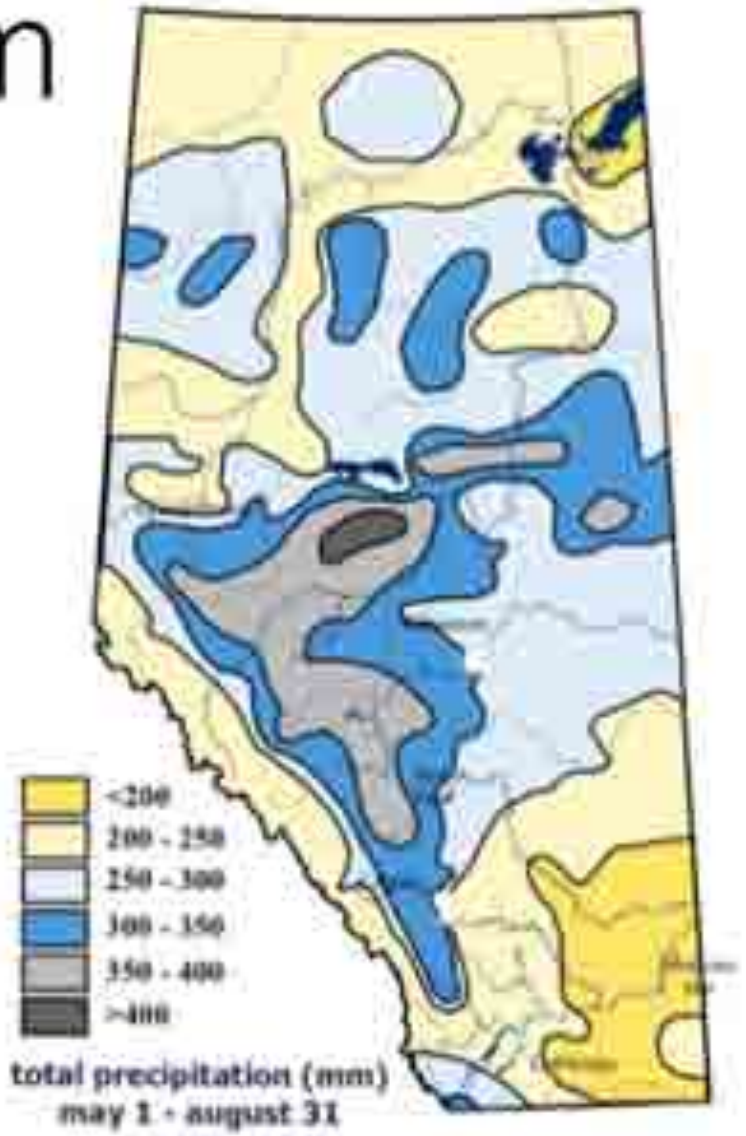
Alberta's irrigation and Crops grown there

Risako Yamamoto

Alberta's irrigation system

There is less precipitation than needed in southern part of Alberta during growing season

Store mountain snowmelt and spring rainfall to put to use when and where it's most needed



Efficiency and sustainability of irrigation water

A typical on-farm pivot irrigation system

- Irrigation type

  Gravity
  ↓
  Wheelmove
  ↓
  High Pressure Pivot
  ↓
  Low Pressure Pivot

- Method of transportation

  Canals to pipeline

Efficiency and sustainability of irrigation water

A typical on-farm pivot irrigation system

- Irrigation type

Gravity	30-60%
↓	
Wheelmove	60-70%
↓	
High Pressure Pivot	73%
↓	
Low Pressure Pivot	84%

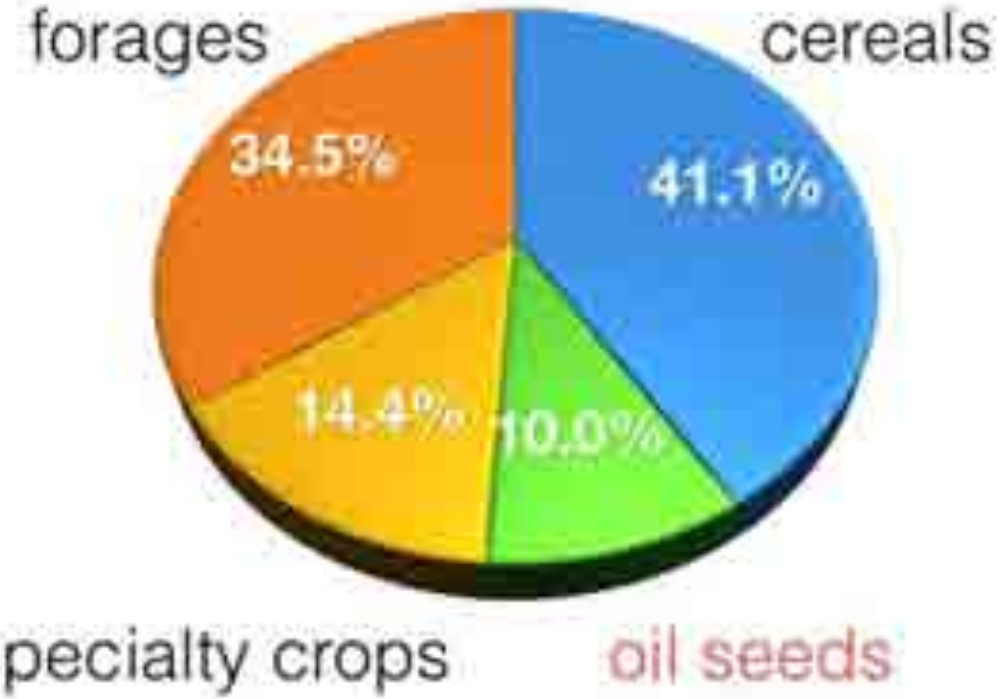
- Method of transportation

Canals to pipeline

Crop Diversification

- Barley
- Wheat
- Alfalfa
- Canola
- Potatoes
- Sugar beats

etc.



Major crops grown on irrigated land in alberta

How is Canola used ?

- Edible oil
- Grease
- Cattlefood

Canola (seeds)

Animal Agriculture-Eating the "Kitchen Garbage" of Crop Production

The “too” complex

Too Dry

Too Toxic

Too hilly

ANIMAL AGRICULTURE

Beef Cattle

Dairy

Poultry

Swine

DGS from Ethanol or Beer Production

DGS- Distiller's Grains with Solubles

Distiller's Grains with Solubles

- Inclusion rates in feed formulation
  - Monogastrics
  - Ruminant
- Wet or Dry?

Canola Meal products from oilseeds

- Protein source
- Feed quality concerns?

Animal to Human Use Efficiency

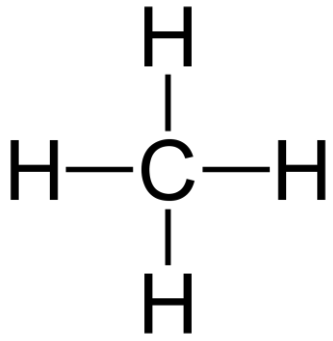
Do humans use animal products and byproducts effectively and efficiently?

The primary way we connect plant and animal agriculture is through byproducts

Biogas Production Linking Animal and Plant Agriculture

Biogas Fermentation

One of the most efficient ways to continue the link between manure and crops

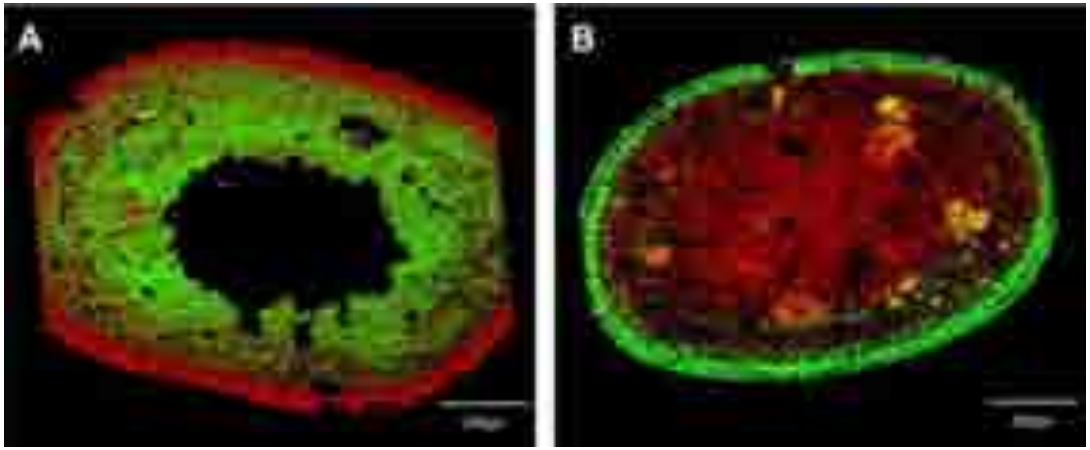


Uses anaerobic respiration of bacteria to sanitize, stabilize, reduce odor, homogenize nutrients and produces gas from wastes.

Manure is mixed with hot water to homogenize it and make it flow easier and is then pumped into the digester

4 Anaerobic Steps

- Hydrolysis – Breakdown of complex organics
- Acidogenesis – Amino acids, and sugars are broken down to alcohol, and carbonic and organic acids



4 Anaerobic Steps

- Acetogenesis – these are further broken into acetic acid, CO2 and hydrogen
- Methanogenesis – using different ways breakdown or build up these last precursors into methane and by products

Using waste is not a new concept however technology has given the ability to extract more and more.

This is what makes biogas and sustainable agriculture interesting

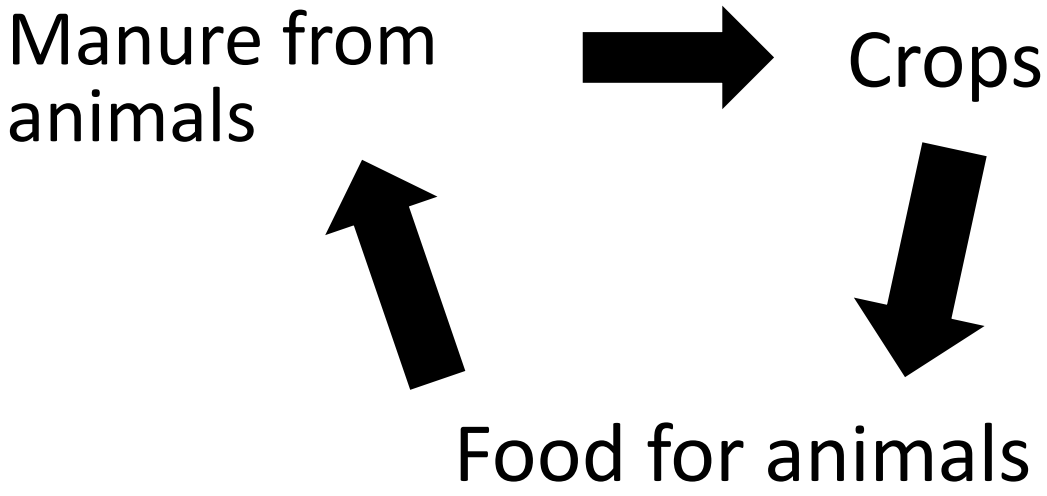
Truly is a byproduct

Vicinity

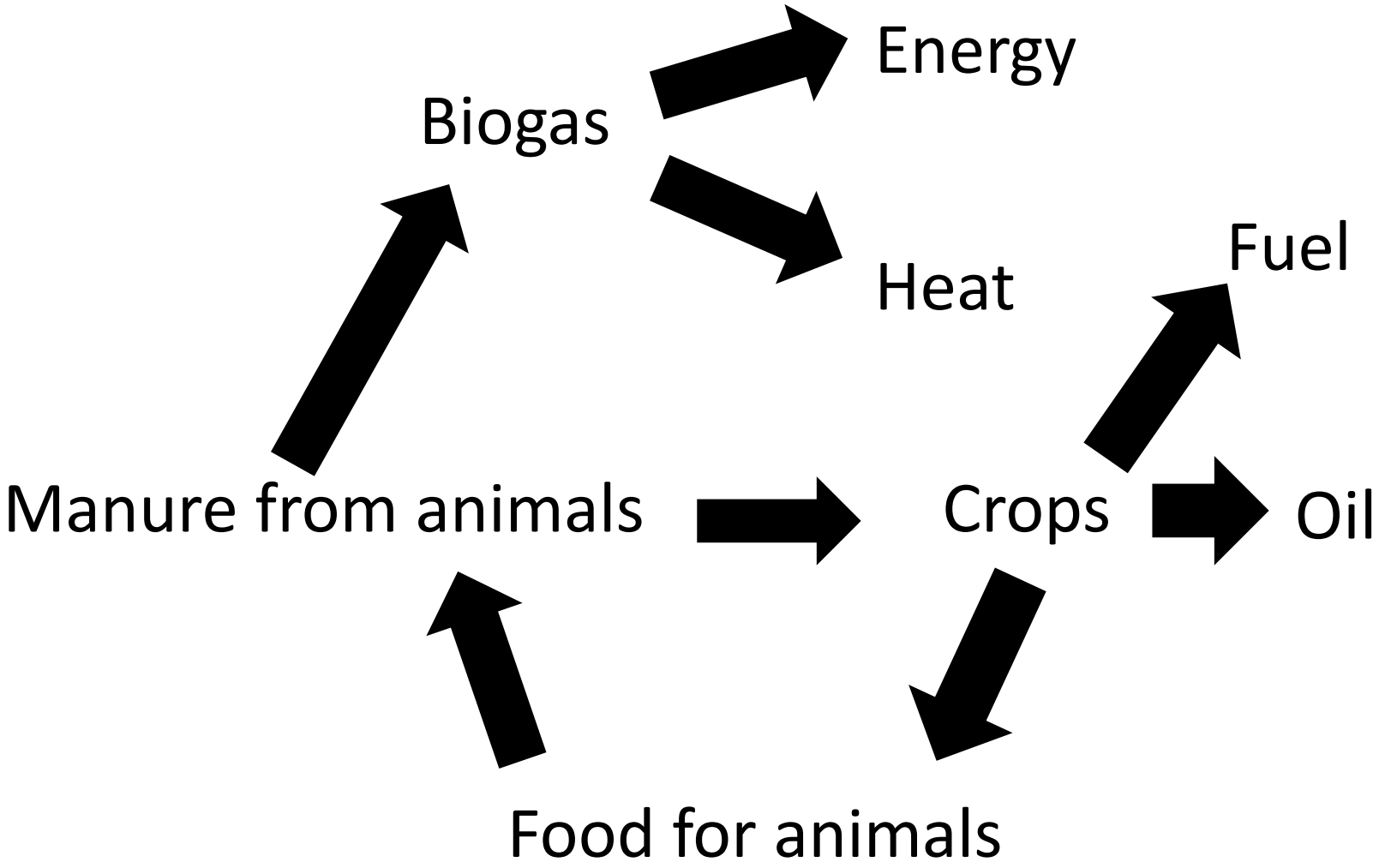
Highland Feeders

- Example: Highland feeders has an ethanol plant, a biogas reactor and a feedlot all on one property
- Future of sustainable agriculture may have something to do with vicinity

Traditional way of agriculture



New way of using byproducts



The most important things to achieve sustainability

① Cost

This is mainly incentive for human.

We have to balance between income and expenditure to continue taking actions.

② Efficiency

This is mainly important for our environment. When it is not efficient, it is not sustainable. This is because we waste resources and harm the environment.

Thank you for listening !

References

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